United States Department of the Interior
Bureau of Land Management

Winnemucca District Office
Winnemucca, Nevada

September 1996

# FINAL

## Environmental Impact Statement
## Lone Tree Mine
## Expansion Project

**MISSION STATEMENT**

The Bureau of Land Management is responsible for the stewardship of our public lands. It is committed to manage, protect, and improve these lands in a manner to serve the needs of the American people for all times. Management is based upon the principles of multiple use and sustained yield of our nation's resources within a framework of environmental responsibility and scientific technology. These resources include recreation, rangelands, timber, minerals, watershed, fish and wildlife, wilderness, air and scenic, scientific and cultural values.

BLM/WM/PL-96/1027+1610

United States Department of the Interior

BUREAU OF LAND MANAGEMENT
Winnemucca District Office
5100 East Winnemucca Boulevard
Winnemucca, Nevada 89445
702-623-1500

In Reply Refer To:
1793/3809
(NV-020)

September 4, 1996

Dear Reader:

Enclosed is the Final Environmental Impact Statement (EIS) for Santa Fe Pacific Gold Corporation's Lone Tree Mine, prepared by the Bureau of Land Management (BLM), Winnemucca District Office.

This Final Environmental Impact Statement analyzes the direct, indirect and cumulative impacts associated with continued mining and expansion of the open pit, ore processing facilities, overburden disposal areas and ancillary facilities.

With the exception of the Chapters 3 and 4 of Cultural Resources and Chapter 4 of Water Resources Sections, the FEIS has been prepared in an abbreviated format and must be used in conjunction with the Draft Environmental Impact Statement (DEIS), issued December 15, 1995. The Cultural and Water Resources Sections are printed in their entirety, due to informational changes between the Draft and Final, with the textural changes highlighted for your reading convenience. The FEIS and the DEIS constitute the complete EIS. The FEIS responds to comments received during the public review period on the DEIS.

Following a 30 day availability period of this FEIS, a Record of Decision will be issued. You may direct comments or questions to Gerald Moritz, Project Manager, at the Bureau of Land Management, Winnemucca District Office, 5100 East Winnemucca Boulevard, Winnemucca, Nevada 89445.

Sincerely yours,

Ron Wenker

Ron Wenker
District Manager

# ERRATA

# SUPPLEMENTAL

This Errata Supplemental presents specific modifications and corrections to the Lone Tree Mine Expansion DEIS. This supplemental insert is an addition to Chapter 3 of this FEIS.

Page 5-4:

The **LIST OF PREPARERS AND REVIEWERS** section in the DEIS (page 5-4 under "**USDI Bureau of Land Management, Winnemucca District Office**") is modified to add the following:

| | |
|---|---|
| Jeff Johnson | Physical Scientist |

# FINAL
# ENVIRONMENTAL IMPACT STATEMENT
# SANTA FE PACIFIC GOLD CORPORATION
# LONE TREE MINE EXPANSION PROJECT

| | |
|---|---|
| **LEAD AGENCY:** | U.S. Department of the Interior<br>Bureau of Land Management<br>Winnemucca District Office<br>Winnemucca, Nevada |
| **PROJECT LOCATION:** | Humboldt County |
| **CORRESPONDENCE ON THIS FINAL ENVIRONMENTAL IMPACT STATEMENT (FEIS) SHOULD BE DIRECTED TO:** | Gerald Moritz, EIS Coordinator<br>Winnemucca District Office<br>Bureau of Land Management<br>5100 E. Winnemucca Blvd.<br>Winnemucca, Nevada 89445<br>(702) 623-1 500 |
| **DATE DRAFT EIS WAS MADE AVAILABLE TO THE EPA AND THE PUBLIC:** | December 15, 1995 |
| **DATE FINAL EIS WAS MADE AVAILABLE TO THE EPA AND THE PUBLIC:** | September 13, 1996 |


## ABSTRACT

The Final Environmental Impact Statement (FEIS) provides responses to comments received by BLM during the public comment period on the Draft Environmental Impact Statement (DEIS). The DEIS analyzed potential impacts associated with expansion of the Lone Tree Mine located in northern Nevada, analysis of alternatives to the Proposed Action, and identified mitigation measures to be implemented to eliminate or reduce described impacts. The Proposed Action includes: (1) expansion of the existing Lone Tree Mine open pit, (2) continuation of the mine dewatering and discharge system, (3) expansion of the tailings impoundment facility, (4) expansion of the overburden disposal facility, and (5) reclamation of disturbed areas. Components of both the Proposed Action and No Action Alternative are evaluated in detail in this document. Other alternatives were considered, evaluated, and eliminated from further detailed analysis. The Agency Preferred Alternative includes the Proposed Action with additional mitigation measures.


**Responsible Official for** EIS:

Ron Wenker

Ron Wenker
Winnemucca District Manager

# FINAL ENVIRONMENTAL IMPACT STATEMENT
# SANTA FE PACIFIC GOLD CORPORATION
# LONE TREE MINE EXPANSION

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# CHAPTER 1

# INTRODUCTION

This Final Environmental Impact Statement (FEIS) is prepared for Santa Fe Pacific Gold Corporation's (SFPG) proposed expansion to the Lone Tree Mine located in north-central Nevada. The FEIS contains the Agency Preferred Alternative and a record of written and verbal comments received on the Draft Environmental Impact Statement (DEIS) for the Lone Tree Mine Project. The Lone Tree Mine is situated on private land owned or controlled by SFPG and on public land administered by the United States Bureau of Land Management (BLM). The BLM Is the lead agency preparing this EIS for the proposed mining expansion at the Lone Tree Mine.

The Lone Tree Mine Expansion DEIS was distributed for public comment on December 15, 1995. BLM received written comments and held two public meetings to accept verbal and written comments on the DEIS. The public meetings were held on January 9, 1996 in Winnemucca, Nevada and January 10, 1996 in Reno, Nevada. The comment period on the DEIS ended on February 16, 1996.

Neither written nor verbal comments received during the public scoping period required major changes or revisions in the analysis or impacts described in the DEIS. The DEIS has not been reprinted and, therefore, this document must be read in conjunction with the DEIS which was released for public review on December 15, 1995.

The Agency Preferred Alternative is identified in Chapter 2 of this document. Chapter 3 (Errata) provides specific edits or corrections to text, figures, and tables contained in the DEIS. All comment letters received by the end of the comment period and responses to substantive comments are located in Chapter 4. Appendices to this FEIS contain additional supporting information to the responses in Chapter 4.

# CHAPTER 2

# AGENCY PREFERRED ALTERNATIVE

The FEIS Agency Preferred Alternative is the Proposed Action. The Agency Preferred Alternative is described on pages 2-51 and 2-52 of the DEIS.

Mitigation measures, which may be required by BLM to reduce potential impacts resulting from the Proposed Action, are described in Appendix A of this FEIS.

# CHAPTER 3

# ERRATA

This Chapter contains specific modifications and corrections to the Lone Tree Mine Expansion Project DEIS. These corrections include revised text, tables, and figures from the DEIS. The Cultural Resources section from Chapters 3 and 4 of the DEIS, and the Water Resources section from Chapter 4, have been completely reprinted in this Errata section of the FEIS because of numerous revisions to these sections. For these reprinted sections for Cultural Resources and Water Resources, changes from the DEIS are indicated in bold italics lettering. All corrections and revisions in this Errata section were made in response to comments received during the public comment period. In addition, some changes incorporate updated data and information which have been compiled since release of the public DEIS in December 1995.

The following are Errata based on page number in the DEIS:

Page S-1:

The **SUMMARY** section in the DEIS (page S-1, column 2, 2nd full paragraph, 4th sentence) is modified as follows:

> "Flotation concentrate produced at the Lone Tree Mine would be stockpiled and shipped to SFPG's Twin Creeks Mine or another off-site facility for final processing."

Page S-4:

The first paragraph under Cultural Resources is revised as follows:

> "Three cultural resource sites have been identified within the area of direct effect for the Lone Tree Mine Expansion Project. None of these sites are eligible for the National Register of Historic Places."

Page 1-9:

**Table 1-2** (Issues and Concerns Identified in Scoping) in the DEIS (page 1-9) is revised as follows under the heading **Permits and Regulatory Compliance**: "Amounts of fill that would be placed in Waters of the United States or jurisdictional wetlands. Involvement of Corps of Engineers and requirements for 404 permit. Chapter 4 - Vegetation p. 4-45" (see Revised Tables section at the end of this chapter).

Page 2-26:

The **Surface Water Control Facilities** section in the DEIS (page 2-26, column 1, 3rd full paragraph) is revised by deleting the last sentence, "Surface water sediment ponds that catch run-off from mine facilities are located in Sections 1 and 11, T34N R42E."

Page 2-27:

The following revisions apply to the section **Potentially Acid-Producing Rock** in the DEIS:

Page 2-27, column 1, paragraph 2:

> "Results of the Lone Tree testing program are provided in Chapter 4 - Geology and Minerals. Humidity cell tests on Lone Tree overburden demonstrated that silicate buffering is an important process in weathering of overburden. The humidity cell results were also used in predicting the amount of metals and acid released from wall rocks (PTI 1994). Static testing, humidity cell tests, and meteoric mobility tests indicate that Lone Tree overburden stockpiles will have an excess neutralization potential (PTI 1995)."

Page 2-27, column 2, paragraph 3:

"Humidity cell tests on the Lone Tree Mine tailings indicate that sulfide species in the samples oxidized to form sulfates (WESTEC 1994). However, acidity, alkalinity, and pH data indicate that there is a sufficient amount of neutralizing capacity to neutralize acid and maintain pH levels in the neutral range (WESTEC 1994).

**Table 2-2** presents the analytical results for the Meteoric Water Mobility Procedure (MWMP) of representative tailing samples. The MWMP attempts to simulate conditions under which precipitation might leach constituents present in the tailing material. NDEP guidance dated November 2, 1990 considers ore and other beneficiation wastes for which the MWMP exhibits a concentration less than 10 times the MCL to be benign. If the extract exceeds 10 times the MCL, but is less than 100 times the MCL, NDEP requires a technical evaluation of the place and manner of use that substantiates that the waste will be stabilized and will not endanger human health or public safety. As shown in **Table 2-2** the extract concentration exceeded the respective MCLs for pH, TDS, sulfate, arsenic, copper, and iron. However, none of the extract concentrations were greater than 10 times the respective MCL. Based on the MWMP data, the tailing material would be considered benign and is not expected to pose a threat to the environment (WESTEC 1994)."

Page 2-28:

**Table 2-2** (Meteoric Water Mobility Procedure Results, Tailings Composite Samples) in the DEIS (page 2-28) is revised to include the drinking water standards for comparative purposes (see Revised Tables section at the end of this chapter). It is noted, however, that the tailings are in a lined facility that is designed not to leak; therefore, drinking water standards are not directly applicable.

Page 2-56:

Second paragraph in column 1 is revised as follows:

"Based on updated geochemical modeling, the quality of pit lake water is not predicted to be conducive to recreational use. Elevated levels of some chemical constituents could preclude development of aquatic communities and fish (see Appendix E in this FEIS for a summary of the pit lake risk assessment)".

Page 3-37:

**Table 3-10** (Water Quality Criteria and Standards for Nevada) in the DEIS (page 3-37) is modified to include new and revised values (see Revised Tables section at the end of this chapter).

Page 3-38:

**Table 3-11** (Water Quality Standards for Humboldt River at Comus Gage Control Point) in the DEIS (page 3-38) is modified to incorporate regulatory changes to the standards and to add the parameter sulfate (see Revised Tables section at the end of this chapter).

Page 3-39:

**Table 3-12** (Summary of Humboldt River Water Quality Data in Vicinity of Lone Tree Mine) in the DEIS (page 3-39) is modified to include new and revised parameters (see Revised Tables section at the end of this chapter).

Page 3-51:

**Figure 3-13** (Groundwater Monitoring Wells) in the DEIS (page 3-51) is modified to include additional wells (see Revised Figures section at the end of this chapter).

Page 3-56:

The **Groundwater Quality** section in the DEIS (page 3-56, column 2, last sentence of first full paragraph) is revised as follows:

"Iron, copper, and lead are the only parameters which have exceeded the aquatic life standard in mine discharge water."

Page 3-57:

**Table 3-19** (Summary of Groundwater Quality Data in Vicinity of Lone Tree Mine) in the DEIS (page 3-57) is revised to include antimony and fluoride (see Revised Tables section at the end of this chapter).

Page 3-58:

**Table 3-20** (Summary of Mine Dewatering Discharge Water Quality) in the DEIS (page 3-58) is modified to include: additional chemical constituents for discharge monitoring; revised permit limits for some parameters; calculated hardness-dependent aquatic life standards; and water quality standards for the Humboldt River at the Comus gage control point (see Revised Tables section at the end of this chapter).

Page 3-85:

The **Threatened and Endangered Species** section in the DEIS (page 3-85, column 1, paragraph 1, 1st sentence under "Birds") is modified as follows:

"Bald eagles (threatened) are periodic seasonal migrants and winter residents in Nevada."

Page 3-87:

The **Candidate and Sensitive Species** section in the DEIS (page 3-87, column 1, paragraph 3 under "Plants") is modified to correct the spelling of the subtitle to:

"Nevada oryctes"

Pages 4-46 & 4-47:

The **Vegetation** section of the DEIS (page 4-46, column 2, last paragraph, 2nd sentence, and page 4-47, continuation of paragraph from page 4-46) is modified as follows:

"However, three springs (Treaty Hill, Brooks, and Hot Pot) have ceased flowing within the last 5 years, probably as a result of below-normal precipitation and mine dewatering. Two springs (Planck and Stonehouse) were dry in 1990 before Lone Tree Mine dewatering was initiated."

Page 4-48:

The **Terrestrial Wildlife** section of the DEIS (page 4-48, column 2, first full paragraph, second sentence) is modified as follows:

"Three springs (Treaty Hill, Brooks, and Hot Pot) located in the vicinity of the Lone Tree Mine have ceased flowing within the last 5 years, probably in response to Lone Tree Mine dewatering and/or several years of below-average precipitation. Two springs (Planck and Stonehouse) were dry in 1990 prior to initiation of mine dewatering at Lone Tree Mine."

Page 4-50:

The **Aquatic Habitat and Fisheries** section of the DEIS (page 4-50, column 2, paragraph 2) is modified as follows:

"Concentrations of dissolved metals in the pit lake would increase to levels which are likely to be toxic to aquatic organisms. These concentrations in combination with the expected absence of shallow, littoral zones along the shore of the pit lake would limit development of an aquatic community (ENSR 1996)."

Page 4-51:

The **Threatened, Endangered, and Candidate Species** section in the DEIS (page 4-51, paragraph 1, 2nd sentence under "Summary") is revised as follows:

"Threatened bald eagles and endangered peregrine falcons periodically may be present

in the study area or as transient winter residents; however, the Proposed Action would not adversely affect these species."

Page 4-69:

The **Cumulative Effects** section in the DEIS (page 4-69, column 2, 1st sentence, last paragraph under "Mining Activities") is modified as follows:

"Disturbed acreages for existing and reasonably foreseeable mining activity in the Lone Tree cumulative effects area are tabulated in **Table 4-7**."

Page 4-70:

The **Cumulative Effects** section in the DEIS (page 4-70, column 1, 1st sentence of the last paragraph) is revised as follows:

"In addition, to the projects listed in **Table 4-7**, one existing project and two foreseeable projects have been identified by BLM."

Page 4-73:

**Table 4-7** (Existing and Reasonably Foreseeable Mining Disturbance in the Lone Tree Cumulative Effects Area) in the DEIS (page 4-73) is modified to clarify the comments column for mines 12 through 17 (see Revised Tables section at the end of this chapter).

Page 4-78:

The **Cumulative Effects** section in the DEIS under "Threatened, Endangered, and Candidate Species" (page 4-78, 2nd column, last paragraph) is revised as follows:

"Regionally, fish and waterfowl populations could increase in the Humboldt River drainage with increased discharge of mine water."

Page 5-7:

The **LIST OF PREPARERS AND REVIEWERS** section in the DEIS (page 5-7 just before "Editor") is modified to add the following additional preparer:

**Resource Concepts, Inc.**

Cultural Resources:
Mr. Charles Zeier
Resource Concepts, Inc.
Carson City, Nevada

Page 5-7:

The **LIST OF PREPARERS AND REVIEWERS** section in the DEIS (page 5-7 under "Special Reviewers") is modified to add the following additional reviewer:

Groundwater Flow Modeling:
Dr. William Woessner
Department of Geology
University of Montana
Missoula, Montana

Page 6-11:

The **REFERENCES** section in the DEIS (page 6-11) is revised as follows:

Replace the PTI (1994) reference with: *PTI Environmental Services (PTI), 1995. Assessment of Pit-Lake Chemogenesis and Waste-Rock Characterization at the Lone Tree Mine, Nevada. Prepared for Santa Fe Pacific Gold Corporation, Valmy, Nevada. January 1995.*

# CHAPTER 3 - CULTURAL RESOURCES

Bold and Italics Indicate Revisions Made to the DEIS

# CULTURAL RESOURCES

The goal of cultural resource management is to maintain and enhance historic and prehistoric cultural resource values. Emphasis is placed on conservation of archaeological and historic sites to better understand the lifestyles and behavior of early societies. Although all cultural resources provide information collectively on the past, some sites contain information for research, public interpretation, and use by future generations. Prehistoric resources are physical locations with a cluster of features and/*or* artifacts that are the result of human activities occurring prior to written records. Historic resources are clusters of features and/or artifacts left by human activity after written records were common. These resources are recorded as sites or isolates.

Prehistoric site types represented in the project area include lithic scatters, campsites, and isolated finds. Prehistoric quarry sites are not known in the Valmy/Stonehouse area, but the Tosawihi quarries, about 35 miles to the northeast, were an important source of stone for tools.

Historic cultural resources in the project area are primarily related to two main historic themes: transportation and mining. The site types include: ***the emigrant trail and camp spots; state routes and stations; railroad grades, stations, and construction camps; old roadways and related features; mineral exploration features; and habitation sites.***

## Cultural History of the Regional Study Area

Human occupation of the Humboldt Basin began during the Pre-Archaic (6000-10,000 B.C.) period, but information is limited and suggests that the human groups were small, very mobile, and relied on hunting in an environmental setting that was wetter and cooler than the present climate. Although fluted points have been found, the most significant evidence of Pre-Archaic occupation is from a site at Rye Patch Reservoir (Davis 1984). During the latter part of the Pre-Archaic, large-stemmed and lanceolate projectile points came into common use as weaponry and have been found along pluvial lake shores (Bedwell 1973), along the Humboldt River (Rusco 1982), and in the Crescent Valley (Soper 1992).

Around 6000 B.C., the climate became much drier and warmer and very little cultural evidence exists for human occupation in the Humboldt Valley until ca. 2500 B.C. At that time, pinyon juniper woodland expanded into the eastern and central Great Basin and up into the higher elevations, although this ecosystem apparently did not exist north of the Humboldt River (Rusco 1982; Thomas 1983).

This area of the Humboldt Valley saw increasing occupation during the Archaic period from 2500 B.C. to 850 B.C. Cross-dating stone tools with radiocarbon-dated sequences in caves and deeply buried sites in the Humboldt Basin suggests that permanent winter camps existed along the Humboldt for hunting, seed gathering, and other special activities. Associated with the Middle Archaic period are the Gatecliff series (Pinto style) and Humboldt series projectile points. ***Archaeological inventories indicate that large winter encampments were located along the Humboldt River (Elston et al. 1981; Rusco and Davis 1979). Sites located away from the river represent special activities (e.g., hunting camps or seed gathering locations).***

The Archaic tradition in the valley continued and the next period was characterized by Elko series projectile points dating from 850 B.C. to 700 A.D. The Rose Spring series characterized the Late Archaic, dating from A.D. 700 to 1300. Around A.D. 1300, small triangular and side-notched arrow points (Desert side-notched and Cottonwood series) became common along with Intermountain Brown Ware pottery. Linguistic and archaeological evidence suggests that Numic speakers moved into the Great Basin at this time and that these peoples are the direct ancestors of the Paiute and Western Shoshone.

Archaeological remains at James Creek Shelter include windbreak-like features and grass-lined features such as those common to the Western Shoshone and Northern Paiute in historic times.

During the eighteenth century, horses and other European goods were obtained by many Native American groups from the Mexicans to the south. However, there was little direct Euro-American contact with the Great Basin until 1828 when Peter Skene Ogden of the Hudson's Bay Company trapped beaver along the Humboldt River between present-day Winnemucca and Elko. For the next several years, Ogden's Hudson's Bay Company successors, John Work, Joseph Walker, and others led trapping expeditions through the area. Little impact resulted from these expeditions since they were of short duration and involved small groups of trappers (Carlson 1974; Cline 1972).

Settlers bound for Oregon and California followed the trappers along the Humboldt beginning with the Bidwell-Bartleson party in 1841. In 1843 a party with wagons led by Joseph Walker followed the Thousand Springs Trail to Idaho. The California Gold Rush saw some 197,600 emigrants and their livestock using the Emigrant Trail between 1849 and 1860. The route of the trail crossed south of the river in the area of Lone Tree Hill and crossed to the north side of the Humboldt River again at Iron Point. There was no "one" trail but a series of trails often superimposed on each other. The emigrants commonly moved away from the main trail to find better campsites; water and grass for stock; or to hunt. Historic sites providing evidence of the trail include wagon ruts, campsites, rest spots, trading posts, remains of deserted wagons or material, remains of animals that died along the way, and gravesites (Carlson 1974; Cline 1972; Elliot 1973; Hill 1986).

Beginning in 1851, the Overland Mail was carried along the Humboldt and stages routinely stopped at the Stonehouse Station. Besides the "Jackass Express" which carried the mail through the 1850s, there were a number of freight and stage companies. The freight routes needed only a narrow travel corridor and left few remains other than specific stations along the trail and overnight camp spots situated at regular intervals between stations (Rogers and Zeier in Soper et al. 1992). ***One such stage station and eating house was built at Stonehouse Spring, located near the project area. This station was in operation from the early 1850s through the late 1860s.***

The native peoples were pushed back from the rivers and the water sources as their lands became a "highway." In 1857 the Western Shoshone attacked an emigrant party in the area of Battle Mountain, thus providing a name for the location (***Bancroft 1981:206***).

When the discovery of mineral wealth near Dayton and Virginia City in the late 1850s opened up Nevada as a primary area for exploration, interest in north-central Nevada began. In 1866 the Battle Mountain Mining District, 20 miles south of Stonehouse, was organized, and relatively intensive activity continued until 1885. As mining camps sprang up in the mountainous areas, wide valleys with dependable water were settled to supply the miners (Bancroft 1981; Carlson 1974; Lincoln 1982; Bowers and Muessig 1982; Smith et al. 1983).

In 1869, the Central Pacific Railroad (CPRR) was constructed through the Humboldt Valley. In response to the railroad, some settlements, such as Battle Mountain, were moved closer to the rail line and other stations and sidings were established along the route. ***Stonehouse Spring was the site of a siding and a section station.*** In 1899 the CPRR was sold to Southern Pacific Railroad (SPRR) and in 1903 the route was partially realigned, requiring new stations and sidings. In 1908 the Western Pacific Railroad (WPRR) constructed a line roughly paralleling the SPRR between Winnemucca and Wells (Britton and Rey 1866; Carlson 1974; Smith et al. 1983). Rogers and Zeier in Soper (1992) note that a number of different types of historic sites can be expected along the old railroad grades. Generally, the archaeological remains consist of trash scatters and occasionally a few associated features from tent camps related to railroad construction and maintenance activities.

During the 1870s and 1880s, cattle ranching became a significant economic factor in northern Nevada and along the Humboldt River. But severe winters in 1889 and 1890 killed whole herds, thus devastating the cattle industry. The

remaining ranchers reduced the size of their herds and began feeding cattle during the winter. To produce hay for feed, they established irrigation systems in the valleys (Bowers and Muessig 1982). From the 1890s to the 1920s some ranchers began raising sheep, which were able to withstand the often harsh conditions of the area (Rowley 1989). Remains of the ranching/farming era include trash scatters from sheep camps, irrigation ditches, line camps, corrals and loading chutes, watering troughs, and fence lines.

During the first few decades of the twentieth century, mining boomed again. The emphasis was on silver and copper, and the nearby Battle Mountain Mining District underwent a brief flurry of activity. Prospecting was relatively intense throughout the region with some development occurring in the Iron Point Mining District, which was organized in 1918 (Lincoln 1982). ***Closer to the project area, Joseph Planck began prospecting around Lone Tree Hill about 1910. He built a house and lived near Planck Spring for some time.***

Although there were roads through the Humboldt Valley, the first highway was constructed after World War I. As part of the national Good Roads movement, which was triggered by the increase in motorized vehicles, the transcontinental Victory Highway (State Route 1, U.S. 1, U.S. 40) was constructed along the Humboldt River corridor (Smith et al. 1983). The present interstate highway (I-80) essentially follows the route of the Victory Highway, and remains of the early highway are noted occasionally along the present interstate.

## Cultural Resource Surveys in the Area of Potential Effect

***Figure 3-23 illustrates the Area of Potential Effect (APE) as defined in 36 CFR Part 800 for the Proposed Action. For the most part, the APE includes federal lands onto which existing Lone Tree Mine facilities would expand. Private lands also are included in the APE if federal authorization allows for the expansion of a facility that would not occur in the absence of a federal action. The result is a discontinuous APE for the Proposed Action. Major disturbance areas included in the APE are:***

***1) a portion of the expanded mine pit;***

***2) a portion of the expanded tailings impoundment facility;***

***3) a portion of the expanded overburden disposal facility;***

***4) a portion of the expanded heap leach facility; and***

***5) several narrow slivers of disturbance in areas where reclamation would extend slightly the existing footprint of previously disturbed areas.***

***The entire APE has been inventoried to Class III standards. Figure 3-23 depicts the location of seven cultural resource inventories that occur within or cross into the APE; information regarding the inventories is provided in Table 3-40. The first inventory conducted in the APE was by Price in 1988. His examination of a proposed power line corridor leading from the Valmy Power Plant (CR2-2269[p]) failed to identify any cultural resources in or near the APE. A bulk of the inventory completed for the Lone Tree Mine was conducted by Johnson (1990a, 1990b, 1990c, 1990d). Johnson's work was documented in projects CR2-2376[p], CR2-2384[p], CR2-2396[p], and CR2-2678[p] and covered some 3,166 acres in and around the APE. Soper (1992) inventoried 4,100 acres in the general Lone Tree area (CR2-2485[p]), effectively completing examination of the APE and the general Lone Tree Mine Project area. The only other inventory that intercepts the APE is one conducted by Obermeyr and Dugas (1995). That work (CR2-2632[p]) was conducted on behalf of a proposed right-of-way and just skirts the southeast edge of the APE.***

***Three cultural resources identified as a result of these inventories are located, in part or in whole, within the APE (Table 3-41); they are sites CrNV-22-5162, CrNV-22-5282, and CrNV-22-5563. Consultations between the BLM and the Nevada State Historic Preservation Office (NSHPO) have resulted in a determination that these resources are not National Register eligible. Depending on the criteria under which they are considered eligible, impacts may occur to properties even though they are located outside the boundary of the existing or proposed operation. Two properties eligible to the National Register based on Criterion A are located just north of the APE. Site CrNV-22-5544 is the Central Pacific Railroad grade and site CrNV-22-5556 is a large, multi-***

*component, historic period site that contains abundant evidence of habitation.*

*During inventory CR2-2485, site CrNV-22-5559 was recorded as a portion of the transcontinental railroad grade. However, further review showed it to be a berm created during construction of I-80. Originally considered eligible under Criteria A, site CrNV-22-5559 subsequently has been determined ineligible to the National Register by the BLM and NSHPO.*

*Inventories conducted outside the APE but within the general area of the Proposed Action are listed in Table 3-42. Two of those inventories (Hause 1994 and Ataman 1995) were conducted on private lands and have not been submitted to the BLM or the NSHPO for review. Each inventory report contains recommendations as to the National Register eligibility of identified cultural resources, but formal agency eligibility determinations have not been made.*

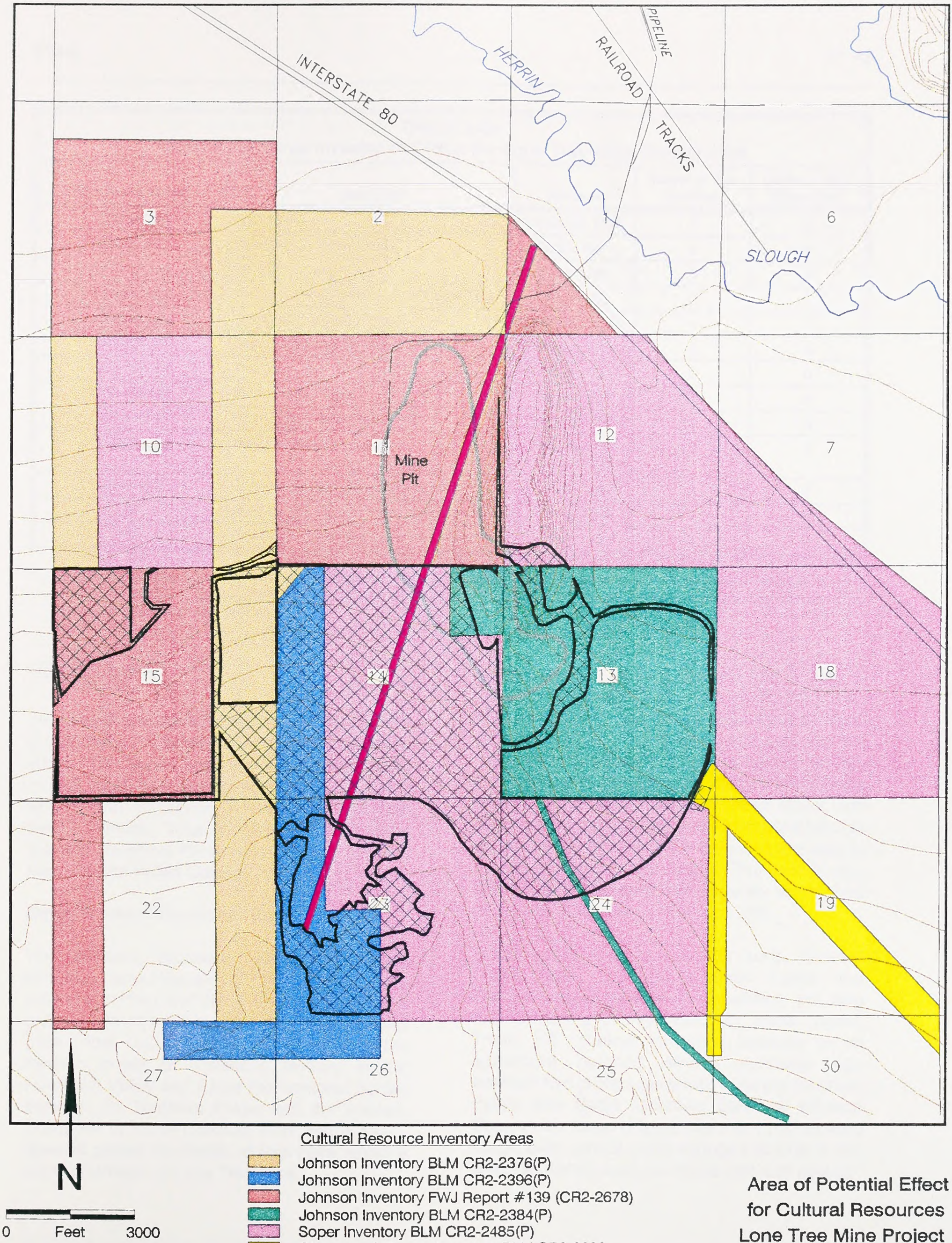
TABLE 3-40
Cultural Resource Inventories Completed Within the Area of Potential Effect

| BLM Report Number | Report Title | Reference | Number of Sites Recorded in APE | Number of NRHP Eligible Sites |
|---|---|---|---|---|
| CR2-2269(p) | Valmy - Stonehouse 120 kV Power Line | Price 1988 | 0 | 0 |
| CR2-2376(p) | The Lone Tree Hill Project | Johnson 1990c | 1 | 0 |
| CR2-2396(p) | The Lone Tree Hill Project II | Johnson 1990a | 0 | 0 |
| CR2-2384(p) | Stonehouse Mining Project | Johnson 1990b | 1 | 0 |
| CR2-2485(p) | Stonehouse Project | Soper 1992 | [illegible] | 0 |
| CR2-2632(p) | Trenton Canyon Project | Obermeyr & Dugas 1995 | 0 | 0 |
| CR2-2678(p) FWJ-139 | Comprehensive Lone Tree Hill Project | Johnson 1990d | 0 | 0 |

NOTE: APE - Area of Potential Effect; NRHP - National Register of Historic Places. See Figure 3-23 for inventory areas and APE.

TABLE 3-41
Cultural Resources Within the Area of Potential Effect

| Cultural Resource | Inventory Reference | Resource Type | National Register Eligibility |
|---|---|---|---|
| CrNV-22-5162 | Johnson 1990c | Prehistoric Lithic Scatter | Not Eligible |
| CrNV-22-5282 | Johnson 1990b | Prehistoric Lithic Scatter | Not Eligible |
| CrNV-22-5563 | Soper 1992 | Prehistoric Lithic Scatter | Not Eligible |




Cultural Resource Inventory Areas

- Johnson Inventory BLM CR2-2376(P)
- Johnson Inventory BLM CR2-2396(P)
- Johnson Inventory FWJ Report #139 (CR2-2678)
- Johnson Inventory BLM CR2-2384(P)
- Soper Inventory BLM CR2-2485(P)
- Obermeyr & Dugas Inventory BLM CR2-2632
- Price Inventory BLM CR2-2269(P)
- Area of Potential Effects

Area of Potential Effect
for Cultural Resources
Lone Tree Mine Project
Humboldt County, Nevada
FIGURE 3-23

| TABLE 3-42<br>Cultural Resource Inventories Within the Lone Tree Mine Project Area | | | | |
|---|---|---|---|---|
| **BLM Report Number** | **Report Title** | **Reference** | **Number of Sites Recorded** | **Number of NRHP Eligible Sites** |
| CR2-262(n) | Soil Piles | Ypsilantis 1978 | 0 | 0 |
| CR2-578(p) | Stonehouse Right-of-way | Smith 1981 | 0 | 0 |
| CR2-1070(p) | I-80 Betterment | Miller 1985 | 0 | 0 |
| CR2-2269(p) | Valmy to Stonehouse 120 kV Power Line | Price 1988 | 0 | 0 |
| CR2-2376(p) | The Lone Tree Hill Project | Johnson 1990c | 1 | 0 |
| CR2-2384(p) | Stonehouse Mining Project | Johnson 1990b | 1 | 0 |
| CR2-2396(p) | The Lone Tree Hill Project II | Johnson 1990a | 0 | 0 |
| CR2-2485(p) | Stonehouse Project | Soper 1992 | 1 | 1 |
| CR2-2488(p) | Fiber Optic Cable Along I-80 | Stornetta 1993 | 0 | 0 |
| CR2-2632(p) | Trenton Canyon Project | Obermayr & Dugas 1995 | 0 | 0 |
| CR2-2678(p) | Comprehensive Lone Tree Hill Project | Johnson 1990d | 2 | 0 |
| NA | Pipeline and Canal for the Lone Tree Mine | Hause 1994 | 9 | 5* |
| NA | Cooling Pond for the Lone Tree Mine | Ataman 1995 | 6 | 0* |

* Inventories by Hause and Ataman were conducted on private property. Neither report has been submitted to the BLM. As a result, BLM and NSHPO eligibility determinations are not available. Information contained in this table reflects recommendations contained in the technical reports.

## Ethnography

The general ethnographic background for the APE is essentially the same as the area of cumulative effect. The issues and information given below include data from the literature and discussion with Western Shoshone groups (Battle Mountain Band, Temoak Tribe of Western Shoshone; Western Shoshone Preservation Society; and the Winnemucca Indian Colony Council).

### Newe/Western Shoshone History

The Western Shoshone living near Battle Mountain named the area of the Humboldt Valley around Iron Point and Valmy "Tonomudza" after a greasewood-covered mountain north of the valley (Inter-Tribal Council 1976). This area is the western extent of Shoshone territory in the Humboldt Valley and forms the territorial border between the Northern Paiute and the Western Shoshone or Newe (Steward 1938; Harris 1941). Steward places the border at Iron Point, about 8 miles northwest of Lone Tree Mine.

Historically, the records indicate four groups of Western Shoshone lived in the Humboldt Valley, although all are part of the Winnemucca Band (Wasson 1994). The westemmost group is the Tosawihi or White Knife, whose traditional territory included the Humboldt River Valley around Battle Mountain, the lands drained by Rock Creek, and other northern tributaries of the Humboldt from as far west as Golconda or Winnemucca and east to the Independence Mountains. The area is also within the geographic boundaries established under the Ruby Valley Treaty of 1863.

Because the area is a border zone, Steward (1938) notes that the Northern Paiute and Tosawihi experienced some hostilities, but also intermarried and intermixed to some extent. Treaty Hill received its name because of an agreement reached several centuries ago between two groups (assumed to be the Northern Paiute and Battle Mountain Band of Western Shoshone). Legend has it that many battles were fought over control of the springs and river in this area. At some point the chiefs met and agreed

that all land "on the side of the rising sun" was to belong to one group and land on the side of the setting sun to the other (WPA 1991).

The Tosawihi occupied the area north of Battle Mountain and, as with the other Western Shoshone, maintained winter camps along the Humboldt. Steward (1938) estimated that during the 1870s and 1880s there were approximately 500 people in a 1,280-square-mile area between Battle Mountain and Iron Point in the "buckbrush" (Battle Mountain Band 1994). During spring, summer, and fall, food was gathered by small family groups that roamed over the valley and mountains gathering and hunting specific plants and animals. Food sources included fish from the river (a major winter food source), seeds and roots from the valleys and higher elevations, and game such as deer, antelope, and rabbit from the sage-covered valleys. Medicinal plants were also gathered along the sloughs (Battle Mountain Band 1994). Occasional dances and communal hunts, such as rabbit drives, would draw these individual family groups together (Steward 1938; Harris 1941). Johnson (1990) refers to a reported historic Indian camp between Stonehouse and the Humboldt River; this site may be the Rock House or Pagawi noted by Steward (1938) as a location for cooperative rabbit drives. Steward (1938) also notes that antelope drives were common near Iron Point and were conducted with the assistance of a Paiute antelope shaman.

Land claim disputes, specifically interpretation of the Ruby Valley Treaty, remain an ongoing social and political issue among the Newe/Western Shoshone. Although the U.S. Supreme Court in 1985 determined that the Western Shoshone had been paid for the lands covered by the Ruby Valley Treaty, many Newe/Western Shoshone argue that the land has never been ceded to the U.S. Government. The ideology of this movement is further reflected through Newe/Western Shoshone traditionalism, wherein there is a link to the aboriginal territories geographically defined by the Ruby Valley Treaty.

**Newe/Western Shoshone Worldview**

Newe believe that the world was first under water except the mountain peaks. As the water receded, the first human beings moved to the foothills and springs, and from then on all the plants, animals, and spirits were relatives. This established the various economic, social, and kinship ties that the Newe continue to have with animals, plants, and spirits (Steward 1938).

Springs are important to the Newe/Western Shoshone for spiritual reasons and because numerous medicinal plants grow nearby. Water sources are believed to have "Puha," a power that has an affinity for water (although it is also present on mountains and throughout the landscape) and is important to the well-being of the Newe people. Puha is also believed present at prehistoric archaeological sites and graves.

Prayer and other spiritual activities are designed to properly acquire and employ Puha, and there are specific "power spots" where this can be done. These locations include springs, mountains, mountain passes, and caves (Clemmer 1989; Harris 1941; Hultkrantz 1979; Liljebald 1972).

**Consultation**

In meetings with Western Shoshone groups, specific concerns were raised about the region outside the area of direct effect, but not the area of direct effect itself. For example, the Battle Mountain Band reported the Humboldt River to the north of the area of direct effect was historically used for camping, hunting, berry gathering, and collection of medicinal plants. The local springs, such as those at Treaty Hill and Stonehouse, were also traditional camping areas for the Western Shoshone. The Hot Pot Springs have been and continue to be used by the Battle Mountain Band who believe the springs have healing powers (Ramos 1995). In Newe/Western Shoshone belief, hot springs are important because spirits called "water babies" are found in them.

Primary concerns expressed by the Newe/Western Shoshone are as follows:

1. Dewatering efforts have resulted in the reduction and stoppage of flow from the springs and may result in similar changes to other springs. Water sources are important to maintain the harmony of an area in keeping with traditional beliefs on a spiritual and practical level. Specifically, water sources, particularly springs, are important because medicinal plants grow in the riparian areas and the water supports fauna in the area. Hot springs are of particular concern because their association with water babies, healing, and because of the Puha associated with all water sources.

2. Potential drying of sloughs between the Lone Tree Mine and the North Valmy Station power plant is a concern because of the berries and medicinal plants that grow in those areas.

# CHAPTER 4 - WATER RESOURCES

Bold and Italics Indicate Revisions Made to the DEIS

# WATER RESOURCES

## Summary

*The proposed Lone Tree Mine expansion would require continued dewatering for a longer period as the mine pit expands laterally and vertically. Mine dewatering was initiated at Lone Tree in 1991. Declining groundwater levels surrounding the mine pit caused by pumping would continue to increase the size of the cone of depression, affecting flows of some springs and the Humboldt River in the study area. When dewatering ceases at the end of year 2006 for the Proposed Action, the Lone Tree Mine pit would begin to fill with groundwater. Water depth in the pit would eventually approach the pre-mining water table elevation* ***and stabilize at an elevation of approximately 4,425*** *feet above MSL. The maximum lateral extent of groundwater drawdown would occur in about year 2036 for the Proposed Action.*

***Three*** *springs (Treaty Hill, Brooks, and Hot Pot) located in the vicinity of the Lone Tree Mine have ceased flowing within the last 5 years, probably in response to Lone Tree Mine dewatering and/or several years of below-average precipitation.* ***Two springs (Planck and Stonehouse) were dry in 1990 prior to initiation of mine dewatering.*** *No additional springs or seeps are located within the expanded cone of depression that is predicted for the Proposed Action. The primary impact on springs and seeps associated with the Proposed Action would be to extend the period of effect on flows at the five spring sites mentioned above.*

*Water levels in some groundwater wells would be affected by the cone of depression associated with mine dewatering. Water table drawdown would extend in a generally circular pattern approximately 5 to 7.5 miles from the Lone Tree Mine pit. Most of the private water supply wells within the expanded groundwater cone of depression associated with the Proposed Action are for the North Valmy Station power plant, town of Valmy, and Marigold Mine. The majority of these wells are completed in valley alluvium that is poorly connected with the bedrock system being dewatered by the Lone Tree Mine. Maximum impacts on springs, seeps, and groundwater levels would occur roughly between years 2000 and 2036, followed by groundwater recovery to approximately 90 percent of the pre-mining static water level about* ***42*** *years after dewatering ceases for the Proposed Action.*

*Excess mine water from the dewatering system would continue to be discharged to the Humboldt River via the existing pipeline and canal system. The current dewatering rate of about 25,000 to 30,000 gpm (56 to 67 cfs) would increase to an average of about 55,000 gpm (123 cfs) for the Proposed Action, with peak discharge rates of about 75,000 gpm (167 cfs) during the last 2 years of mining. This water generally would meet discharge standards without treatment with the exception of temperature and arsenic. A treatment plant* ***has been*** *constructed to assure that discharge water meets appropriate standards. The discharge water is thermal with a current temperature of approximately 90°F (32°C) and a possible maximum temperature of 110° to 120°F (43° to 49°C) near the end of mining. Cooling of discharge water will occur in the* ***existing*** *cooling pond system, with the temperature lowered to within 2°C of ambient water temperature in the Humboldt River or the most current applicable standard.*

*Surface water flow in the Humboldt River near the mine site would be reduced by a maximum of about 200 gpm (0.45 cfs) after dewatering ceases for the Proposed Action. This compares with a reduction in river flow of about 90 gpm (0.2 cfs) that would occur if currently authorized mining ceases in year 1999. Reduction in surface water flow would be most significant during the first 30 years after cessation of mining. During mine operations, flow in the Humboldt River below the Herrin Slough confluence would increase year-round because of Lone Tree Mine water discharge at increasing rates of up to 75,000 gpm (167 cfs). This represents an approximate 50 percent increase in average annual flow of the Humboldt River near the mine site. These increases would end in year 2006 for the Proposed Action and in year 1999 for authorized mining on private land only.*

*The Lone Tree Mine pit would eventually fill with groundwater resulting in a lake that would have an ultimate depth of about* ***865*** *feet, and cover an area of approximately* ***280*** *acres. Most of the pit lake would form during the first* ***42*** *years after dewatering is discontinued. After that time, the water level would continue to approach the premining groundwater level until a steady-state condition is achieved. For mining on private land only, two smaller pit lakes would develop in Sections 11 and 13. Evaporation of water from the pit lake surface will occur indefinitely.*

*A study utilizing laboratory tests and computer models was conducted to predict the quality of water that would collect in the mine pit for the Proposed Action. After the initial **42**-year period of pit infilling, the Lone Tree pit lake would approximate a hydraulic steady state where groundwater inflow would be nearly balanced by groundwater outflow and evaporative loss. Model results indicate that evaporative loss would cause **some elements** in the pit lake to **increase with time. When the pit lake reaches hydraulic steady state after 160 years of infilling, antimony, arsenic, fluoride, and thallium are predicted to exceed primary drinking water standards. Secondary standards for aluminum and pH (upper limit) also are predicted to be exceeded in the pit lake. Modeling of pit lake water mixing with downgradient groundwater after hydraulic steady state in the pit shows that all element concentrations would decline to below drinking water standards within a distance of about 100 feet of the pit.***

*Additional direct and indirect impacts associated with the Proposed Action could occur as a result of expanded mine facilities. Disturbed areas such as overburden disposal sites, ore stockpiles, leach pads, mine pits, pipeline corridors, roads, and ancillary facilities would increase erosion potential. Potential for impacts from erosion and acid rock drainage is expected to be low because of construction techniques, monitoring and mitigation plans, and the arid environment.*

## Direct and Indirect Impacts

Direct and indirect impacts on groundwater and surface water resources would result from expansion of the Lone Tree Mine. These impacts would be associated primarily with dewatering activities necessary to allow continued mining below the groundwater table.

### Proposed Action

#### *Dewatering System*

Groundwater currently is pumped from numerous dewatering wells at the Lone Tree Mine to keep the mine pit dry and maintain stable pit walls. Some of the water is consumed at the mine site for ore processing, road watering, and other related uses. Excess mine water is and would continue to be discharged to the Humboldt River via the existing canal and cooling pond system.

Dewatering at Lone Tree was initiated in 1991 with a discharge rate of less than 10,000 gpm (22 cfs); the current dewatering rate ranges from about 25,000 to 30,000 gpm (56 to 67 cfs). Water consumption at the mine site would average approximately 2,000 gpm (4.5 cfs). The duration of groundwater pumping would increase for the Proposed Action as the mine pit expands onto BLM land.

Dewatering of the mine pit would be required until the end of year 2006, after which groundwater withdrawal would be terminated except for relatively small quantities required for reclamation and processing purposes. For currently authorized mining that would continue only on private land, dewatering would cease in year 1999. Predicted groundwater withdrawal rates through year 1999 and year 2006 are presented in **Figure 4-1**. The maximum dewatering rate of 75,000 gpm would be similar for both scenarios; however, dewatering would occur for an additional 7 years for the Proposed Action. This would result in an additional 0.6 million acre-feet of groundwater being removed during the life of the mine under the Proposed Action. Currently about 10 wells are used for dewatering; the number of dewatering wells would increase as the mine pit continues to expand. A water treatment facility *will* reduce arsenic concentrations prior to discharge to the Humboldt River.

A hydrogeologic-based numerical model was developed to predict necessary dewatering rates into the future at the Lone Tree Mine (HCI 1994a, 1995b, ***1996a, 1996b***). The model predicts that total groundwater pumping for the Proposed Action would range from a rate of 44,000 gpm (98 cfs) in 1995 to a maximum of 75,000 gpm (167 cfs) just prior to the end of dewatering in year 2006 (**Figure 4-1**). This rate includes a conservative factor for the model results.

#### *Groundwater Flow Model*

The numerical groundwater flow model performed by HCI (1994a, ***1996b***) for the Lone Tree Mine predicts the amount of groundwater that must be removed from the mine pit area during the life of mine, providing the basis for designing an

effective dewatering system. In addition, the model predicts the extent of groundwater drawdown, or cone of depression, that would result from dewatering. Impacts on streamflows in the modeled area also are predicted. Finally, the model predicts the rate at which groundwater would flow into the mine pit after dewatering operations cease.

The model uses a proprietary computer program *"MINEDW"* to predict or model three-dimensional groundwater flow with an unconfined water surface using the finite-element method (HCI 1994a). This program was developed by HCI to solve problems related to mine dewatering. Geologic, hydrologic, and climatological data are incorporated into the conceptual hydrogeologic model describing groundwater and surface water flow in the study area. The model was calibrated to known conditions, such as recharge values, water level elevations, stream baseflows, and hydraulic testing results (drawdown and recovery tests). Model calibration is an ongoing activity and will continue in the future to refine predictive capabilities and improve efficiency of dewatering operations.

All groundwater models, including *MINEDW*, are predictive tools; their effectiveness is a function of the hydrogeologic data utilized. The Lone Tree Mine has developed a comprehensive hydrologic database in the mine pit area to supply information for the model. Predictions of groundwater drawdown and streamflow impacts must be considered with the understanding that actual conditions may deviate from the predictions. Specific results of the model are discussed below.

***Impacts on Groundwater Levels***

A groundwater cone of depression around the mine pit has been developing since 1991 and would continue to expand for the Proposed Action as a result of the Lone Tree Mine dewatering operations. Pumped groundwater for dewatering is obtained primarily from fractured bedrock units (e.g., Wayne Zone); however, some water also flows from the alluvium that is intercepted by portions of the mine pit. The predicted extent of groundwater drawdown using the 10-foot drawdown contour for the end of mine dewatering and the maximum extent of drawdown is shown in **Figures 4-2** and **4-3**, respectively. Dewatering would be terminated in year 2006 for the Proposed Action and in year 1999 for the existing mine plan for mining on private land.

The alluvium generally is in the northern half of the groundwater drawdown area shown on these figures. The lateral extent of drawdown is similar in both alluvium and bedrock; however, the vertical magnitude of groundwater drawdown is greater in bedrock (see Impacts to Wells section below). Maximum extent of groundwater drawdown would occur in year 2036 for the Proposed Action and year 2010 for the existing mine plan (HCI 1994a, 1995b). Total volume of groundwater removed by the Lone Tree Mine dewatering system during the period 1995 through 2006 would be approximately 1 million acre-feet.

Water table drawdown greater than 10 feet would extend in a generally circular pattern approximately 5 to 7.5 miles from the Lone Tree Mine pit (**Figure 4-2**). Groundwater drawdown of several hundred vertical feet would occur in bedrock close to the mine pit during the dewatering period (**Figure 4-4**). Groundwater drawdown in alluvium generally located north, east and west of the Lone Tree Mine pit has a lateral extent similar to bedrock (HCI 1995c); however, the vertical magnitude is less in alluvium in comparison to bedrock because of the clayey nature of the unconsolidated sediments (see Impacts on Wells section below). Groundwater drawdown would also occur outside of the maximum 10-foot contour line; however, water level changes in these areas would be difficult to distinguish from seasonal or long-term variations in natural conditions. Therefore, only the 10-foot groundwater drawdown contour is presented in the figures.

Some localized increases in groundwater levels would occur in alluvial material underlying the cooling pond area and the lower reaches of Herrin Slough where discharge water infiltrates to the subsurface. These infiltration rates, however, are expected to be minimal due to the clayey nature of alluvium in this area. Some of the

discharge water would also dissipate into the atmosphere due to evaporation, primarily at the cooling pond. Maximum evaporation rate from the Stage 1 cooling pond system (206 acres) would be approximately 720 acre-feet per year (450 gpm or 1.0 cfs) based on a net evaporation rate of 3.5 feet per year. These characteristics of infiltration and evaporation for the cooling pond would also occur for the current mine plan; however, the duration would extend an additional 7 years for the Proposed Action.

After mining ceases in year 2006, the pit would begin to fill with water and the groundwater cone of depression would continue to expand until about year 2036 (**Figure 4-5**). The pit would continue to fill with water after year 2036, but the cone of depression would begin to get smaller laterally and vertically as the water table rises toward the pre-mining level. The vertical magnitude of groundwater drawdown is greatest in year 2006 (**Figure 4-4**), then becomes shallower even as the cone of depression continues to expand to year 2036 (**Figure 4-5**).

**Figure 4-6** displays cross sections of the mine pit with groundwater drawdown and recovery. Initial rate of water recovery in the mine pit would be relatively rapid, followed by a decreasing rate of pit infilling as hydraulic gradients into the pit decline. Groundwater in the mine pit is predicted to recover to approximately 90 percent of the pre-mining static water level about ***42*** years after dewatering ceases for the Proposed Action, and about 13 years after dewatering for the current mine plan (HCI 1994a, 1995b, 1995e, ***1996b,***). The pre-mining groundwater elevation in the Lone Tree Mine area was about 4,460 feet above MSL (approximately 40 feet below ground surface). ***The final steady state pit lake elevation is predicted to be approximately 4,425 feet above MSL (HCI 1996b). Hydraulic steady state of the pit lake is predicted to occur after about 160 years from termination of dewatering.***

***Impacts on Wells***

Some wells within the groundwater cone of depression surrounding the Lone Tree Mine pit may be affected due to decreased water yield, increased pumping costs, or possibly lowering the water level below the well or screen interval. After dewatering ceases for the Proposed Action in year 2006, groundwater levels in the center of the cone of depression would begin to rise, whereas wells near the outside of the cone of depression would experience declining water levels until year 2036. Wells completed in bedrock material near the Lone Tree Mine would have the most significant effects because they are directly connected to the primary formations being dewatered by the mine. For the Proposed Action, effects on wells would occur for an additional 7 years beyond the effects associated with the current mine plan where mining will occur on private land only. In addition, the groundwater cone of depression would expand further as a result of continued dewatering to year 2006, potentially affecting additional wells in this area.

**Figure 4-7** shows locations of known private wells in the study area, excluding Lone Tree Mine's dewatering and monitoring wells. The figure also shows the predicted maximum extent of the 10-foot drawdown contour for the water table system for years 2010 and 2036. These well locations are based on water rights and well log data obtained from the Nevada State Engineer's Office. No water right is necessary to produce from a domestic well in Nevada; therefore, there probably are domestic wells in the study area that are not included in **Figure 4-7**. Wells outside the maximum 10-foot drawdown contour line should be relatively unaffected by mine dewatering and groundwater drawdown.

Available information for wells located within the predicted 10-foot drawdown contours is summarized in **Table 4-2**. Wells shown on **Figure 4-7** within the year 2010 drawdown contour would be affected for a longer period as a result of the Proposed Action. Only those wells located between the two groundwater contours shown on **Figure 4-7**, however, would be affected solely by the Proposed Action. Most of these wells are in the vicinity of the town of Valmy and associated with the Marigold Mine southeast of the Lone Tree Mine. Some of the wells in the Valmy area are associated with the North Valmy Station power plant. Water level recovery in affected wells would be extended for the Proposed Action.

Most of the wells associated with the power plant and the town of Valmy are over 200 feet deep and completed in alluvial material; static water levels generally are about 50 feet below ground surface (Simon Hydro-Search 1992c). The existing and proposed Lone Tree Mine dewatering should have minor effects on water levels in alluvial wells because the clayey alluvial material is not well connected hydraulically to the bedrock being dewatered at the mine.

The Marigold Mine operates three production wells approximately 5 to 7 miles southeast of the Lone Tree Mine. These wells are completed in bedrock material to depths that range from 450 to 700 feet and produce a total of 500 to 1,000 gpm for mining and milling purposes. Water production rates may increase to more than 1,500 gpm for future operations (Protani 1994). The Marigold Mine will continue to operate for at least five more years. Groundwater levels in the three Marigold Mine production wells have been variable since 1989. Groundwater in one of the wells has declined as much as 20 feet over the 6-year period (Marigold Mining Company 1995). Based on the groundwater drawdown modeling results conducted by HCI (1994a, 1995a, 1995b) and water level monitoring data, the cone of depression associated with the Lone Tree Mine currently has not reached the Marigold Mine. However, the cone of depression is predicted to reach the Marigold Mine wells after year 2000 for the Proposed Action (**Figure 4-7**). Therefore, groundwater level declines in the Marigold wells prior to about year 2000 probably are the result of pumping from the Marigold wells and/or drought conditions. After year 2000, approximately 20 feet of additional groundwater drawdown could occur in the Marigold wells due to Lone Tree Mine dewatering.

Dewatering currently affects water levels in the Lone Tree Mine monitoring wells. **Figure 3-14** shows water level changes in selected monitoring wells. Monitoring wells completed in bedrock near the mine show the greatest water level declines since initiation of mining. In contrast, most wells completed in alluvium have had relatively small water level changes.

Water levels in bedrock monitoring wells close to the Lone Tree Mine have generally declined 150 to 200 feet or more. Bedrock wells at greater distances from the mine (3 to 5 miles) typically have declined from less than 10 to approximately 50 feet. Water level changes measured in monitoring wells completed in alluvium within 2 miles of the mine site are variable; some water levels have risen a few feet, while others have declined up to approximately 50 feet. One alluvial well (SS-3) completed adjacent to the mine pit has declined approximately 100 feet since February 1994; however, this well has been affected by pumping from another nearby well used as part of a pit wall stability program. Alluvial wells completed 4 to 5 miles from the mine site have declined from less than 1 foot to approximately 10 feet, with the exception of well M/O 35-19-1B which has declined about 33 feet since September 1993. Changes in groundwater levels in the study area probably are due to a combination of mine dewatering, natural fluctuations, climatic variations, and/or other private groundwater withdrawals.

Quality of groundwater is not expected to be affected by the Lone Tree Mine and associated dewatering operations during the life of mining. No significant changes in the hydrogeologic system that controls groundwater quality would occur as a result of the proposed mine expansion. Predicted mine pit water quality and resultant groundwater quality after cessation of mining is discussed in a later section (see Impacts from Mine Pit Water Recovery section in this chapter).

***Impacts on Springs and Seeps***

Eighteen springs have been identified within the Lone Tree Mine study area (radius of about 10 miles from mine site) (**Figure 4-8**). Within the boundary of the projected maximum 10-foot groundwater drawdown contour line for the Proposed Action (year 2036), four springs have been inventoried (**Figure 4-8**). The 10-foot drawdown contour line extends for a distance of approximately 5 to 7.5 miles from the Lone Tree Mine. The four springs within this predicted

groundwater cone of depression are: Treaty Hill, Brooks, Stonehouse, and Planck springs. These four springs, as well as Hot Pot Springs located outside but within 1 mile of the 10-foot drawdown contour, have ceased flowing. ***Treaty Hill, Brooks, and Hot Pot Springs ceased flowing*** within the last 5 years, probably due to a combination of mine dewatering and below-average precipitation. ***Planck and Stonehouse springs were dry in 1990 prior to initiation of Lone Tree Mine dewatering (DiGrazia 1990).***

**Table 4-3** summarizes information for the five springs mentioned above and three other springs located within 2.5 miles of the predicted maximum extent of the 10-foot drawdown contour (Sulphur, Mud, and Ames springs; **Figure 4-8**).

Stonehouse and Planck springs were located on the northeast side of Lone Tree Hill within 1 mile of the Lone Tree Mine. Brooks Spring is located approximately 5 miles west of the Lone Tree Mine; this spring reportedly went dry in about 1992 (Filbin 1992). Water flow at Brooks Spring has been replaced temporarily with water piped from the Lone Tree Mine at a rate of about 35 gpm. Treaty Hill Spring, located about 2 miles northeast of the mine, was reported to have water in 1991 and was dry in 1993 (RCI 1993).

From 1963 to 1964, flow rates at Hot Pot Springs reportedly declined from 400 to 70 gpm (**Table 4-3**). A steady decline also has been observed at Hot Pot Springs from April 1993 to January 1995 of 52 gpm to no flow. Since January 1995, the water level in the main Hot Pot Spring opening has continued to decline, as well as a decrease in the water temperature. Water in Hot Pot Springs probably issues from a deep bedrock source that may be connected to the Lone Tree Mine dewatering system. Additional monitoring of flow at Hot Pot Springs will help determine if the spring system is connected to mine dewatering.

The other three springs in **Table 4-3** and **Figure 4-8** -- Sulphur, Ames, and Mud springs -- are included in this impact analysis because they are sufficiently close to the predicted maximum groundwater cone of depression that they may be affected. Precipitation recharge in the Edna Mountains and structural control from a fault system likely form Sulphur Spring. Flow rates at Sulphur Spring range from approximately 1 to 3 gpm with a temperature of 19°C (**Table 4-3**). Ames and Mud Springs appear to be discharges of perched water from the Battle Mountains.

The Proposed Action would increase the duration of effect on impacted spring flows as a result of dewatering for an additional 7 years. No additional springs beyond those previously discussed are located within or near the maximum groundwater drawdown area. Only Brooks Spring is located within the expanded cone of depression associated with the increased duration of dewatering for the Proposed Action (**Figure 4-8**). Flow in affected springs should resume when the groundwater pressure or head that provides water to the spring sites recovers sufficiently during the groundwater recovery period. Complete recovery of some springs may take ***160*** years ***or more***.

Water rights information for the eight springs discussed above is contained in **Table 4-3**. Water rights have been identified for Treaty Hill, Stonehouse, Planck, Sulphur, Ames, and Mud springs.

***Impacts on Streamflow***

The Humboldt River is the only perennial stream or river in the study area. Other drainages are ephemeral or intermittent, flowing only in response to precipitation and/or snowmelt. Many of these streams flow in the mountainous areas and then dissipate in the valleys due to infiltration and evaporation. As a result, the only impact on streamflow from dewatering at the Lone Tree Mine would occur in the Humboldt River. Other ephemeral and intermittent streams should not be affected by dewatering because they generally are not connected to the groundwater system. Springs that provide flow to these streams are located in mountain areas where groundwater likely is perched and not connected with deeper groundwater being pumped by the Lone Tree Mine.

During the dewatering period through year 2006 for the Proposed Action, flow in the Humboldt River downstream of the Herrin Slough

**TABLE 4-2**
**Groundwater Wells Within Maximum 10-Foot Drawdown Contour**

| Location[1] | Owner[2] | Water Right Status & No.[3] | Lithology | Well Depth (ft) | Water Level (ft) | Major Use[4] |
|---|---|---|---|---|---|---|
| 35N-42E-25-NESE | Santa Fe Mining | WDR-57068 | --- | --- | --- | mining |
| 35N-43E-34-NESE* | SPPC | ABR-30318 | --- | --- | --- | irrigation |
| 34N-41E-12-SESE* | SFPG | EXP-58257T | bedrock | --- | --- | stock/expired |
| 34N-42E-1-SWSW | SFPG | PER-57103 | bedrock | --- | --- | other |
| 34N-42E-1-SWSW | Christison | RFP-58666 | --- | --- | --- | irrigation |
| 34N-42E-1-SWSW | Ellison Ranch | RFP-58743 | --- | --- | --- | irrigation |
| 34N-42E-1-SWSW | SFPG | APP-59628 | bedrock | --- | --- | mining |
| 34N-42E-11-SENE | Christison | RFP-58825 | --- | --- | --- | irrigation |
| 34N-42E-11-NE&SE | SFPG | 53 separate water rights | bedrock | --- | --- | mining |
| 34N-42E-11-SENE | Pinson Ranch | RFP-58667 | --- | --- | --- | irrigation |
| 34N-42E-11-SENE | Ellison Ranch | PER-58738 | --- | --- | --- | stock |
| 34N-42E-11-SENE | Ellison Ranch | RFA-58742 | --- | --- | --- | irrigation |
| 34N-42E-11-SESE | Pinson Ranch | RFP-58824 | --- | --- | --- | irrigation |
| 34N-42E-13-NW&SW | SFPG | 10 separate water rights | bedrock | --- | --- | mining |
| 34N-42E-14-NE&SW | SFPG | 10 separate water rights | bedrock | --- | --- | mining |
| 34N-42E-14-NENE | Marigold Mining | WDR-53862 | --- | --- | --- | mining/withdrawn |
| 34N-42E-15-NWNE | SFPG | PER-54764 | --- | --- | --- | mining |
| 34N-43E-7-SWNW | SPPC | 4 separate water rights | alluvium | --- | --- | industrial |
| 34N-43E-16-SWSE | SPPC | PER-47986 | alluvium | 305 | 31 | industrial |
| 34N-43E-16-SESE | SFPG | PER-47988 | alluvium | --- | --- | industrial |
| 34N-43E-16-SWSE | Hunter | ABR-22785 | alluvium | 192 | 34 | irrigation |
| 34N-43E-27-NWNW* | SPPC | CER-29004 | alluvium | --- | --- | industrial |
| 34N-43E-27-NWSW* | Golconda Fire Dept. | PER-58921 | --- | --- | --- | fire protection |
| 34N-43E-27-SWSW* | Di Grazia | PER-46715 | --- | --- | --- | private water supply |
| 34N-43E-27-SWSW* | Valmy Mtn. Vistas Inc | 4 separate water rights | --- | --- | --- | private water supply |
| 34N-43E-27-SWSW* | NV Highway Dept. | --- | alluvium | 258 | 156 | highway rest stop |
| 34N-43E-28-SESW* | Marigold Mining | RFA-58023 | bedrock | --- | --- | mining |
| 34N-43E-28-SESW* | Cordex Exploration | PER-51463 | alluvium | 453 | 120 | mining |
| 34N-43E-33-SWSW* | Marigold Mining | PER-51884 | bedrock | --- | --- | mining |
| 33N-43E-4-SWSW* | Marigold Mining | 8 separate water rights | bedrock & alluvium | 453 | 126 | mining |
| 33N-43E-8-NESE* | Marigold Mining | ABR-51888 | bedrock | 600 | 204 | mining |
| 33N-43E-8-SENE* | Marigold Mining | ABR-51887 | bedrock | 700 | 283 | mining |

[1] Location: township - range - section - ¼ ¼ section; see **Figure 4-7** for location of wells. * = located between the two 10-ft drawdown contours shown on **Figure 4-7** for years 2010 and 2036.
[2] SPPC = Sierra Pacific Power Company; SFPG = Santa Fe Pacific Gold.
[3] Status abbreviations: ABR = abrogated; APP = application; CER = certificate; DEN = denied; EXP = expired; PER = permit; RFA = ready for action; RFP = ready for action (protested); WDR = withdrawn.
[4] Major uses of well water, as shown. Mining use includes all associated activities, such as processing, road watering, and dewatering.
"---" indicates no information available.
Source: Nevada Division of Water Resources 1994; HCI 1994a; Water Management Consultants, Inc. 1992.

confluence would increase with the input of mine water flowing down the existing canal system. The primary effect of the Proposed Action, however, would be to increase the duration of discharge water to the river by 7 years. The discharge rate would average about 55,000 gpm (123 cfs) for the Proposed Action, and reach a maximum of 75,000 gpm (167 cfs) during the last 2 years of mining. This maximum flow rate would also occur for the current mine plan (**Figure 4-1**). Natural flow in the Humboldt River at the Comus and Battle Mountain gages (see **Figure 3-8**) generally exceeds 500 cfs during the period April through June, ranges from 100 to 500 cfs in January, February, March, and July, and is less than 100 cfs from August through December (see Chapter 3, Water Resources, for additional flow information). The Humboldt River in the vicinity of the Lone Tree Mine typically has no flow for several weeks each year during late summer when natural flows are low, irrigation withdrawals are high, and evapotranspiration is high.

The remaining discussion in this section, Impacts on Streamflow, is applicable to both the Proposed Action and the currently authorized action for mining on private land. Both actions included dewatering discharge to the Humboldt River at rates of up to 75,000 gpm (167 cfs). The primary difference is that dewatering would occur for an additional 7 years for the Proposed Action.

Based on mean October flow data of the Humboldt River between the Battle Mountain and Comus gages for the period 1897 through 1981, the river loses approximately 8 cfs during the baseflow period (HCI 1994a). The Comus station is located approximately 34 miles downstream of the Battle Mountain station. Between the Battle Mountain gage and Rye Patch Reservoir, the Humboldt River loses an average annual flow of about 87 cfs; however, during the October baseflow period, the river gains an average of 5 cfs (Zimmerman 1992a). The addition of Lone Tree Mine water to the Humboldt River would temporarily offset reductions in flow that occur in the Humboldt River downstream of the Herrin Slough confluence. According to the Pershing County Water District (Hodges 1994), current discharge of excess water from the Lone Tree Mine has allowed the river to flow during periods when the river is normally dry or frozen, and has increased baseflow conditions.

The magnitude of changes in river flow that would occur and the length of stream that would be affected below the discharge point are difficult to predict because of complex river dynamics, including inflow, outflow, bank storage, evapotranspiration, and irrigation withdrawals. In the vicinity of the Lone Tree Mine, the Humboldt River channel is well confined except under flood conditions. **Figure 4-9** is a representative cross section near the Herrin Slough confluence showing excess mine discharge water plotted with various flows in the Humboldt River. A maximum flow increase of 75,000 gpm (167 cfs) in the Humboldt River is well within the holding capacity for the active channel during typical natural flows. For the maximum average monthly flow in the Humboldt River of 834 cfs, depth of water in the river at the cross section location without the mine water discharge is about 6.1 feet. Adding the maximum discharge water of 167 cfs to the Humboldt River would increase the flow depth by about 0.5 foot (**Figure 4-9**).

The predicted maximum mine discharge of 167 cfs from the Lone Tree Mine to the Humboldt River represents approximately a 50 percent increase in the average annual flow of the river at the Comus gage of 324 cfs (USGS 1995). During high flow conditions in the river, the additional discharge water of up to 167 cfs would have a negligible effect on the water level. The mean annual flood on this portion of the Humboldt River is approximately 1,300 cfs (Stone and Webster 1975); an additional 167 cfs spread out over a flooded area would be an immeasurable increase in water level.

With increased flows in the Iron Point Relief Canal and Herrin Slough, it is possible that flow would exceed the primary channel capacities of the lower section of Herrin Slough more frequently than under natural conditions. This could result in occasional flooding of the surrounding area and increased impacts on man-made improvements that may be within the floodplain near the confluence of Herrin Slough and the

Humboldt River (e.g., Southern Pacific Railroad bed, private roads, and powerline poles). The Iron Point Relief Canal is approximately 8 feet deep and 30 feet wide.

The cooling pond site is located within the 100-year floodplain of the Humboldt River (see **Figure 3-10**). Flooding along the river could affect the cooling pond system; however, a release of warm water from the cooling pond(s) would have no significant impact on the Humboldt River during flood conditions. The cooling pond system may have to be repaired or reconstructed after flood waters that reach the ponds subside. ***It is not likely that the cooling pond berms would be breached because they are 9 to 14 feet high and any flood water that may reach this area would have low velocities.***

Below the Comus gage, the floodplain of the Humboldt River is constricted to a greater degree by surrounding hills than upstream of the gage. The town of Golconda is approximately 50 feet above and 4,000 feet away from the 100-year floodplain (FEMA 1991b). The additional water from the Lone Tree Mine dewatering system

TABLE 4-3
Springs and Seeps Within or Near Maximum Groundwater Drawdown Area

| Spring Name[1] | Legal Location | Location Description | Flow Rate and Temperature | Probable Geologic Source | Water Rights[2] and/or BLM No. |
|---|---|---|---|---|---|
| **Springs Located Within Maximum Predicted 10-Foot Groundwater Drawdown Contour** | | | | | |
| Treaty Hill Spring | T35N R43E, Sec.31,NE | On west base of Treaty Hill; Clovers Basin | dry since about 1992 | Alluvium or bedrock | PER-1929 |
| Stonehouse Spring | T34N R42E, Sec.1,SW | On east flank of Lone Tree Hill; Clovers Basin | dry since before dewatering began in 1991 | Bedrock | PER-17591 |
| Planck Spring | T34N R42E, Sec.12,NW | On east flank of Lone Tree Hill; Clovers Basin | dry since before dewatering began in 1991 | Bedrock | CER-1674 PER-17598 |
| Brooks Spring* | T34N R41E, Sec.13,NE | On north flank of Buffalo Mtn; Pumpernickel Valley | dry since about 1992; 26°C; Lone Tree Mine pipeline replaces water at site | Alluvium or bedrock | CER-4283 VST-V05763 |
| **Springs Located Just Outside Maximum 10-Foot Groundwater Drawdown Contour** | | | | | |
| Sulphur Spring | T35N R41E, Sec.34,NW | On east flank of Edna Mtn; Pumpernickel Valley | 1-3 gpm; full stock tank; other nearby seepy areas; 19°C | Bedrock | CER-33616; VST-V05762; VST-V05997; BLM spring # 65-2,-3,-4,-5,-6 |
| Hot Pot Springs | T35N R43E, Sec.11, SW | Spring complex 3 miles NE of Treaty Hill; Clovers Basin | 400 gpm in 1963; 70 gpm in 1964; declined from 52 to 1 gpm from 4/93 to 11/94; no flow in 1/95. 10-58°C | Bedrock | None identified |
| Ames Spring | T33N R43E, Sec.16,SE | On north flank of Battle Mtn Range; Clovers Basin | Reported "muddy"; spring on USGS map | Perched water in mountains | PER-2513 |
| Mud Spring | T33N R43E, Sec.20,SW | On north flank of Battle Mtn Range; Clovers Basin | Reported "mud with grass"; has flowed in recent past (Protani 1994); spring on USGS map | Perched water in mountains | VST-V04636; BLM spring # 64-15,-16,-17 |

[1] See **Figure 4-8** for locations of springs and predicted maximum extent of 10-foot groundwater drawdown contour. * = located between the two 10-foot drawdown contours shown on **Figure 4-8** for years 2010 and 2036.

[2] Water rights information is based on a review of records and may not be valid water rights or in good standing.

Source: HCI 1994b; LTMI 1995 and 1994b.

would not have any effects on Golconda. SFPG has agreed to temporarily cease discharge of mine water for as long as necessary if the State Engineer makes a finding that cessation of discharge is necessary to prevent exacerbation of flooding conditions in the Humboldt River.

At the town of Winnemucca, approximately 30 miles downstream from the Comus gage, the Humboldt River 100-year floodplain is relatively small (FEMA 1990b). A 100-year flood along the river would cause only minor flooding in the town area. An incremental increase of 167 cfs from Lone Tree Mine dewatering would be negligible in the Winnemucca area. Under nonflooding conditions, the excess Lone Tree Mine water would remain within the river banks in this area.

The Humboldt River enters Rye Patch Reservoir approximately 60 miles below the Comus gage. Under most conditions, additional flow resulting from the Lone Tree Mine discharge would be retained by this reservoir, provided it is not consumed or lost in the intervening distance (via evapotranspiration, seepage, irrigation withdrawals, etc). According to the Pershing County Water District (Hodges 1994), Rye Patch Reservoir has not filled completely during the last 10 years. Incremental effects from increasing flow due to the Lone Tree Mine discharge, therefore, are not expected to propagate below the reservoir on the Humboldt River. Additional water in the reservoir, however, could be available for appropriated water rights.

HCI (1994c) performed a study of backwater effects of mine water discharge into the Humboldt River. A maximum predicted mine water discharge of 167 cfs was added to the maximum average monthly flow in the Humboldt River of 890 cfs. The mine discharge water would increase the river flow depth about 1 foot at these rates at the point of discharge (HCI 1994c). At an upstream distance of approximately 2.6 miles, the rise in river stage due to the mine water discharge would be about 0.5 feet, and no change in water depth would be detectable beyond about 7.6 miles upstream (HCI 1994c). Based on this analysis, there should be no impacts on the upstream towns of Valmy or Battle Mountain. In addition, there are no known features along the Humboldt River immediately upstream of the Herrin Slough confluence that could be impacted by the water level changes.

After cessation of Lone Tree Mine dewatering, flow in the Humboldt River is predicted to decrease because of groundwater recharge in the Lone Tree Mine cone of depression. For the Proposed Action, the decrease in river flow is expected to reach a maximum of approximately 200 gpm (0.45 cfs) at the Comus gage compared to pre-mining conditions (HCI 1994a, 1995b). This maximum loss of river flow to groundwater recharge is predicted to occur in about year 2033, after which there would be a gradual return to pre-mining surface water flow conditions. For currently authorized mining and dewatering on private land, the Humboldt River is predicted to decline in flow by up to about 90 gpm (0.2 cfs) as a result of the groundwater cone of depression (HCI 1995a). A loss of up to 0.45 cfs in the Humboldt River during this period may be detectable during low flow conditions that typically occur in August, September, and October. Minor declines in river flow of less than 0.45 cfs may also occur between the Herrin Slough confluence and the town of Valmy between years 2000 and 2006 as a result of groundwater level declines in the vicinity of the river. No significant impacts are expected from these temporary decreases in Humboldt River flow.

#### *Stream and River Channel Stability*

Channel characteristics of the Humboldt River are summarized in Chapter 3, Water Resources. The addition of up to 75,000 gpm (167 cfs) of excess mine water would cause increased erosion of the river channel, the lower portion of Herrin Slough, and the Iron Point Relief Canal because the mine discharge water would have low levels of suspended sediment. The Proposed Action would increase the total period of time that mine water discharge would go to the Humboldt River. The Proposed Action is not expected to have a significant effect on stream and river channel stability because the maximum discharge rate would not change for the Proposed Action.

The Humboldt River is not expected to experience a significant amount of increased erosion because of its channel capacity and channel bottom/bank stability. The river channel is composed primarily of silt and fine sand, which is sufficiently cohesive to minimize erosion. In addition, larger particles of gravel and cobbles occur in the river channel. Extensive riparian vegetation along the banks of the Humboldt River downstream of the Herrin Slough confluence enhances stream bank stability.

Concentrations of total suspended solids (TSS) in the Humboldt River in the study area prior to initiation of dewatering at the Lone Tree Mine ranged from about 30 to 500 mg/L. The TSS concentration in the Humboldt River is not expected to increase significantly as a result of the Proposed Action because the discharge water entering the river from the existing canal system would have low sediment concentrations due to the low gradient, stable channels, and settling of sediment in the cooling ponds. Once the discharge water enters the Humboldt River at the Herrin Slough confluence, the river would continue to pick up sediment until an equilibrium concentration is attained. This concentration, however, would be similar to ambient levels in the river. ***Additional sediment picked up in the Humboldt River as a result of the mine discharge is expected to occur gradually because of the low river gradient.***

*Impacts on Water Temperature*

Excess mine water that currently is removed via dewatering wells is considered "thermal," with an average temperature of about 32°C (90°F). Maximum water temperatures encountered during the later years of mining may reach 43° to 49°C (110° to 120°F). A cooling pond (Stage 1 = 206 acres) reduces water temperatures to meet Nevada discharge standards (i.e., within 2°C of ambient water temperature in the Humboldt River or the most current standard). Water temperature effects as a result of the Proposed Action are no different than those for the currently authorized action of mining and dewatering on private land. The Proposed Action, however, would increase the duration of discharge to the cooling ponds and Humboldt River.

More cooling of the discharge water naturally occurs in winter than during summer. In contrast, differences in Humboldt River water temperature above and below the Herrin Slough confluence are greatest during winter when the river is near freezing. In summer, the natural temperature of the Humboldt River approaches 30°C, which is close to the discharge water temperature without any cooling. Generally, the natural temperature of the Humboldt River is less than 24°C (75°F) for most of the year.

Thermal modeling has been performed by J.E. Edinger Associates, Inc. (Edinger 1994) to predict changes in temperature of the discharge water and water in the Humboldt River. Without a cooling pond system for the discharge water, excess mine water discharge by Lone Tree Mine into the Humboldt River via the existing canal system would result in maximum temperatures in excess of 29°C (84°F) during portions of the summer when air temperatures are warm and natural flows in the river are low. There are periods during late summer when the Humboldt River typically is dry or nearly dry.

During winter, river temperatures mixed with uncooled discharge water would range from about 45° to 60°F. Addition of mine water to the Humboldt River during the winter provides for year-round flow in the river below the discharge point at the Herrin Slough confluence. As a result of the cooling pond system, no thermal impacts are expected in the Humboldt River system from addition of excess Lone Tree Mine water.

*Impacts on Surface Water Quality*

Groundwater at the Lone Tree Mine that currently is and would continue to be discharged for the Proposed Action has been characterized by samples collected from dewatering wells in the vicinity of the mine pit (see Chapter 3, Water Resources, and **Table 3-20**). This water is obtained primarily from bedrock in the Wayne Zone and generally is good quality with a neutral pH and total dissolved solids of about 400 to 500 mg/L. Total suspended solids usually are less than 10 mg/L and nutrients (ammonia, nitrate, and phosphate) are at low concentrations. The

only metals typically measured above the detection limit are arsenic, iron, ***manganese, and zinc***. Concentrations of arsenic, iron and sulfate have increased recently in the mine discharge water. Dissolved oxygen in the deeper groundwater typically is in the range of 2 to ***6*** mg/L.

As a result of increasing arsenic concentrations in some mine dewatering wells, a water treatment plant ***at the mine site*** reduces arsenic concentrations to acceptable levels. All other parameters are expected to meet water quality standards established by NDEP in the NPDES permit. Therefore, no significant water quality impacts would occur from discharge of excess Lone Tree Mine water to the Humboldt River.

Addition of mine water to the Humboldt River would increase the load of dissolved solids and trace elements in the hydrologic system. For the Proposed Action, this loading would occur for 7 years longer than currently approved mining and dewatering on private land. Numerous factors would influence actual trace element loading for flows that reach Rye Patch Reservoir and/or Humboldt Sink. These include adsorption and absorption on soil particles, vegetation uptake, oxidation, pH changes, and dilution. These physical and chemical processes would occur along many miles of the river, in Rye Patch Reservoir, and the Humboldt Sink. As a result of the complex hydrologic dynamics of transport, chemical uptake, and toxicity, it is difficult to predict actual loads that would occur in the lower reaches of the Humboldt River Basin.

***Impacts from Mine Pit Water Recovery***

At completion of mining and cessation of dewatering, a mine pit lake would form from groundwater inflows. As mentioned in Chapter 3, Water Resources, two smaller pit lakes would develop at the Lone Tree Mine site for currently authorized mining on private land only. The projected bottom of the pit for the Proposed Action would be at an elevation of 3,560 feet; since the ***final steady state pit lake is predicted to be at an elevation of about 4,425 feet above MSL, the*** pit lake would have a ***maximum*** depth of about ***865*** feet and cover an area of approximately ***280*** acres (Table 4-4). The estimated evaporation rate from the final Lone Tree Mine pit lake would be a maximum of ***840*** acre-feet per year (***520*** gpm) based on a net evaporation rate of 3.0 feet per year. This net evaporation rate is less than for the cooling ponds (3.5 feet per year) because the mine pit walls above the pit lake surface reduce evaporation. To evaluate chemistry of the pit lake associated with the Proposed Action, SFPG commissioned a study that utilized existing chemical and hydrogeologic data in conjunction with laboratory tests and computer models (PTI ***1995, 1996***). Important factors that affect water quality in mine pit lakes include pyrite oxidation and acid generation in the pit walls, leaching of metals from wall rock, chemical reactions and evaporative concentration in the water, and chemical and oxygen distribution in the final lake. Three important geological conditions of the Lone Tree Mine pit affect predictions of pit lake geochemistry: (1) rock lower in the pit and on the east wall contains the most pyrite capable of generating acid; (2) there would not be a significant amount of limestone exposed in the pit to act as a buffer for acids generated in the pit; and (3) the Wayne Zone would be the primary conduit for groundwater flow into the Lone Tree Mine pit.

Groundwater in the Wayne Zone has a natural alkalinity (approximately 300 mg/L $CaCO_3$) that has the capacity to neutralize acidic leachate in the pit lake. Laboratory experiments were conducted in which acidic leachate from Lone Tree rocks was mixed with Wayne Zone groundwater. For a near-neutral pH range, iron precipitated rapidly as an amorphous iron hydroxide (AFH) which readily adsorbs heavy metals and arsenic, resulting in relatively low levels of these compounds in the pit lake (PTI ***1995***). Geochemical modeling also indicates metal precipitation.

Pyrite oxidation in the pit walls would affect the loading of metals and acid to the pit lake when the walls are exposed to the atmosphere between excavation and groundwater inflow. Wall-rock oxidation was predicted using a numerical model and calibrated to tests on Lone Tree sulfide wall

rock. Composition of the pit lake was calculated with a model that incorporates static and kinetic tests (measures potential and actual acid release), mine plans, groundwater model results, and chemical modeling. Calculated wall rock leachate was combined mathematically with inflowing groundwater, followed by use of a geochemical model to determine equilibrium chemistry of the pit lake at various time periods following cessation of mining (PTI *1995*).

***Modeling results indicate that the Lone Tree Mine pit lake associated with the Proposed Action would have quality characteristics that remain relatively consistent during the period of infilling. After 42 years, the pit lake is predicted to reach approximately 90 percent of its final level (HCI 1996b). It is predicted that the pit lake would reach essentially steady-state hydraulic conditions approximately 160 years after pit infilling begins (HCI 1996b). Water in the pit lake would be subject to natural buffering by groundwater and adsorptive removal of metals by precipitating AFH (PTI 1995). Pit lake water is predicted to be alkaline (pH = 8.7 - 9.1) at all times during pit lake development. Calculated concentrations of metals in the pit lake at various times after cessation of dewatering are shown in Table 4-5.***

***Beyond the initial 42 years of pit filling, the Lone Tree pit lake would approach a hydraulic steady state where groundwater inflow is balanced by groundwater outflow and evaporative loss. Model results indicate that evaporative loss would cause some elements in the pit lake to increase with time (Table 4-5). Total dissolved solids would reach a concentration of approximately 900 mg/L after 160 years of pit infilling. Three metals are predicted to exceed primary drinking water standards at 40 and 160 years of infilling: antimony, arsenic, and thallium (Table 4-5). When the pit lake reaches hydraulic steady-state after 160 years of infilling, fluoride also is predicted to exceed the primary drinking water standard. Secondary drinking water standards for pH and aluminum are predicted to be exceeded at 40 and 160 years after infilling begins (Table 4-5).***

Model results also show that the Lone Tree pit lake would turn over once each year and would be oxygenated (6 to 10 mg/L dissolved oxygen) over its entire depth throughout the year (PTI 1994). Long-term temperature of water in the pit lake would remain at approximately 5° to 6°C, except at the surface where summer temperatures could reach 29°C (PTI 1994). As a result of these predicted conditions, the final pit lake is expected to be oligotrophic (i.e., clear, low-productivity water).

***Because the predicted median concentrations of several constituents exceed Nevada drinking water standards and because the lake is predicted to have outflow to surrounding groundwater, PTI (1996) evaluated the potential magnitude to which outflow from the Lone Tree Mine pit lake could degrade groundwater. A USGS solute transport model (PATCHI) was used for the simulations that incorporates advection, dispersion, adsorption, and decay. Results of this modeling show the following: (1) pH and aluminum concentrations will decrease to below drinking water standards when the lake water enters the aquifer and the pressure of carbon dioxide increases; (2) at 160 years after mining (i.e., hydraulic steady-state), concentrations of antimony, arsenic, and fluoride in groundwater downgradient of the Lone Tree pit lake (i.e., northward toward Humboldt River) are predicted to be below drinking water standards within 70, 40, and 15 feet of the alluvial/bedrock contact (i.e., north and east sides of Lone Tree Hill), respectively; and (3) observed "background" concentrations of antimony, arsenic, fluoride, and TDS in groundwater in some wells downgradient of the Lone Tree pit exceed drinking water standards for each of these constituents.***

*Surface Erosion and Sedimentation*

Erosion would occur in areas of increased surface disturbance at the Lone Tree Mine. The Proposed Action includes expansion of overburden disposal areas, tailings impoundment, and leach pads.

Sediment associated with disturbance of these areas would tend to accumulate in ephemeral drainageways in the project area. Transport of sediment would occur primarily during periods of rainstorms and snowmelt runoff. Impacts associated with accelerated erosion at the mine site are not likely to be significant (see Soils in this chapter, for additional information on erosion and soil loss). SFPG has developed a monitoring program and best management practices associated with EPA's stormwater regulations.

| TABLE 4-4<br>Future Physical Characteristics of Lone Tree Mine Pit | | | | |
|---|---|---|---|---|
| Year | Mine Activity | Pit Base Elevation (ft) | Water Level Elevation (ft) | Pit Lake Surface Area (acres) |
| 1993 | Excavation | 4,220 | 4,220 | 0 |
| 1994 | Excavation | 4,200 | 4,200 | 0 |
| 1995 | Excavation | 4,180 | 4,180 | 0 |
| 1996 | Excavation | 4,140 | 4,140 | 0 |
| 1997 | Excavation | 4,080 | 4,080 | 0 |
| 1998 | Excavation | 4,020 | 4,020 | 0 |
| 1999 | Excavation | 3,900 | 3,900 | 0 |
| 2000 | Excavation | 3,840 | 3,840 | 0 |
| 2001 | Excavation | 3,840 | 3,840 | 0 |
| 2002 | Excavation | 3,840 | 3,840 | 0 |
| 2003 | Excavation | 3,840 | 3,840 | 0 |
| 2004 | Excavation | 3,840 | 3,840 | 0 |
| 2005 | Excavation | 3,800 | 3,800 | 0 |
| 2006 | Excavation | 3,560 | 3,560 | 0 |
| 2007 | Water Infilling | 3,560 | ***3,973*** | ***70*** |
| ***2016*** | Water Infilling | 3,560 | ***4,248*** | ***180*** |
| ***2031*** | Water Infilling | 3,560 | ***4,334*** | ***230*** |
| ***2048*** | Water Infilling | 3,560 | ***4,368*** | ***250*** |
| ***2061*** | Water Infilling | 3,560 | ***4,382*** | ***250*** |
| ***2168*** | Water Infilling | 3,560 | ***4,425*** | ***280*** |

Source: PTI 1994, HCI 1996b.

TABLE 4-5
Predicted Quality of Lone Tree Mine Pit Lake

| Parameter | Predicted Concentration in mg/L (years after mining)[1] | | | | |
|---|---|---|---|---|---|
| | 1 Year | 40 Years | 160 Years (Steady-State) | Aquatic Life Standards[2] (chronic/acute) | Drinking Water Standards[3] |
| Aluminum | 0.72 | 0.57 | 0.54 | - | 0.05 - 0.2 (s) |
| Antimony | 0.027 | 0.023 | 0.031 | - | 0.006 |
| Arsenic | 0.71 | 0.55 | 0.55 | 0.18/0.342 | 0.05 |
| Barium | 0.024 | 0.027 | 0.026 | - | 2.0 |
| Cadmium | 0.0002 | 0.0003 | 0.0006 | 0.001/0.006 | 0.005 |
| Chromium | 0.0007 | 0.0007 | 0.0007 | 0.010/0.015 | 0.10 |
| Copper | 0.0015 | 0.0021 | 0.0026 | 0.016/0.026 | 1.3 |
| Lead | < 0.0001 | < 0.0001 | 0.0002 | 0.002/0.083 | 0.015 |
| Potassium | 16 | 18 | 29 | - | - |
| Nickel | 0.057 | 0.053 | 0.061 | 0.215/1.935 | 0.1 |
| Sodium | 116 | 137 | 221 | - | - |
| Chloride | 21 | 26 | 40 | - | 250 (s) |
| Fluoride | 2.5 | 2.8 | 4.6 | - | 4.0 |
| Sulfate | 134 | 124 | 154 | - | 250 (s) |
| Zinc | 0.0076 | 0.013 | 0.033 | 0.145/0.160 | 5.0 (s) |
| Magnesium | 14 | 18 | 27 | - | 125 (s) |
| Manganese | < 0.0001 | < 0.0001 | < 0.0001 | - | 0.05 (s) |
| Mercury | 0.0001 | 0.0001 | 0.0002 | 0.000012/0.002 | 0.002 |
| Nitrate | 0.11 | 0.16 | 0.25 | 90 | 10.0 |
| Selenium | 0.0037 | 0.0036 | 0.0040 | 0.005/0.02 | 0.05 |
| Thallium | 0.022 | 0.020 | 0.035 | - | 0.002 |
| Iron (III) | 0.0008 | 0.0010 | 0.0015 | 1.0 | 0.3 (s) |
| Alkalinity | 151 | 200 | 339 | - | - |
| Hardness | 151 | 78 | 115 | - | - |
| Calcium | 3.5 | 2.2 | 1.1 | - | - |
| TDS | 495 | 574 | 895 | - | 500 - 1000 (s) |
| pH | 8.7 | 8.9 | 9.1 | 6.5 - 9.0 | 6.5 - 8.5 (s) |

[1] mg/L = milligrams per liter; 50th percentile concentrations.
[2] Aquatic life standards are hardness dependent for the following metals: cadmium, chromium, copper, lead, nickel, and zinc (see NAC 445A.144); a hardness value of 175 mg/L was used to calculate these standards.
[3] All concentrations reported are primary drinking water standards unless followed by an (s) indicating secondary standards (see NAC 445A.453 & 445A.455). Standards for copper and lead are "action levels" (see Table 3-10).

Source: PTI 1996.

*Mine Processing Impacts*

Impacts on water resources could occur in the Lone Tree Mine area in the following ways: (1) erosion and runoff from disturbed areas; (2) spills of lubricants, fuels, solvents, and cyanide onto the ground surface and into drainageways; (3) acid drainage from overburden and spent ore; and (4) seepage of cyanide into the subsurface from the leach pads and tailings impoundment.

Potentially acid-generating overburden excavated at the Lone Tree Mine would be encapsulated in nonacid-generating overburden. Potentially acid-generating material in tailings and leach facilities would be placed on liner material. The potential for impacts from acid rock drainage is expected to be low because of construction techniques, monitoring and mitigation plans, and the arid environment (see Geology and Minerals in this chapter, for additional information on potential acid rock generation).

The tailings impoundment is designed to contain a 25-year/24-hour storm. Failure of the tailings embankment would be unlikely based on design, operation, and monitoring.

Solutions containing cyanide and metals that are discharged to or utilized at the tailings impoundment, leach pads, and associated ponds would be contained in the lined facilities and eventually would be neutralized during reclamation. Releases of ore-processing solutions during mine operation would be detected by monitoring wells and subsequently corrected.

***Cyanide Fate***

Cyanide process solutions would to be used in the gold recovery process. These solutions are present in the tanks and piping associated with the mill, lined ponds associated with the heap leach facilities, and in the heap leach and tailings disposal facility. SFPG's reclamation and closure plans include provisions to neutralize and detoxify all cyanide solutions and ultimately dispose of them through evaporation. These activities would occur in accordance with NDEP regulations.

Cyanide is a highly reactive and relatively unstable compound. Its toxicity is directly related to the amount of cyanide ion ($CN^-$) and hydrogen cyanide (HCN) present in the solution. Neutralization and detoxification occurs through chemical processes that volatilize hydrogen cyanide, bind the cyanide ion in stable, nontoxic compounds, or otherwise degrade the cyanide into nontoxic constituents. Chemical agents may be used to accelerate these processes, but the proposed method consists of adding water to reduce pH and allowing exposure to air and sunlight to accelerate the degradation processes.

Reducing pH of the cyanide-bearing solution is the primary method of neutralization and detoxification. Cyanide remains in solution only under alkaline conditions (pH > 9). As the pH is reduced through introduction of fresh water, the cyanide is converted to hydrogen cyanide gas and released to the atmosphere. Although hydrogen cyanide gas is highly toxic, releases of gas during neutralization and detoxification would be slow. Hydrogen cyanide gas breaks down readily in the presence of oxygen and sunlight.

Cyanide neutralization and detoxification at the tailings storage facility and leach pads would begin as soon as ore processing is completed. Residual water in the tailings impoundment facility would evaporate or seep through the tailings material to the underdrain system. Seepage would be collected in the seepage collection pond and treated to meet State of Nevada standards (0.2 mg/L weak acid dissociable cyanide and a pH between 6 and 9 standard units). In the arid environment of the mine site, it is expected that continuous seepage of residual tailings solution would cease within 10 years after tailings deposition is halted. This water may contain small amounts of cyanide, but concentrations would be lower than the regulatory limit. Cyanide at these concentrations would not be expected to impact the environment and residual cyanide would decline over time.

Cyanide solution in the leach pads would be neutralized and detoxified by recirculation and evaporation. Fresh water would be introduced onto the leach pads to rinse residual cyanide from the spent ore. Rinse water would be recycled through the leach pad until it meets the regulatory criteria described above. Rinse water would be collected and disposed of through evaporation. If fresh water rinsing does not meet State of Nevada standards, additional neutralization techniques such as hydrogen peroxide treatment would be utilized.

## No Action Alternative

The No Action Alternative would result in similar impacts on water resources that are described above for the Proposed Action; however, the duration for most of these impacts would be less than for the Proposed Action. Mine dewatering was initiated in 1991 at the Lone Tree Mine and will continue through year 1999 under currently approved mine operations on private land (versus year 2006 for the Proposed Action). The existing groundwater cone of depression surrounding the Lone Tree Mine will continue to expand, but will affect a smaller area around the mine pit. Excess

mine water would continue to be discharged through year 1999 for the No Action Alternative; however, the total volume of removed water would be less than for Proposed Action. Two pit lakes would develop in the Section 11 and 13 private land mine pits for the No Action Alternative. Other adverse impacts on water resources that may occur for the No Action Alternative are associated with the overburden disposal facilities, leach pad facilities, and tailings impoundment (e.g., modification of surface water drainage patterns and seepage effects on groundwater quality).

Hydrologic Consultants, Inc. (1995a) completed a numerical modeling simulation of mining and dewatering on private land only (current mine plan for Sections 11 and 13) for the No Action Alternative. Modeling results show the following general conditions: (1) maximum dewatering rate would reach 75,000 gpm (167 cfs); however, pumping would cease in year 1999; (2) total volume of water pumped would be 400,000 acre-feet for the No Action Alternative versus 1 million acre-feet for the Proposed Action; (3) maximum extent of groundwater drawdown associated with dewatering would be less and occur in year 2010 for the No Action Alternative versus year 2036 for the Proposed Action; (4) maximum decrease in Humboldt River baseflow would be approximately 0.2 cfs for the No Action Alternative versus 0.45 cfs for the Proposed Action; and (5) predicted 90 percent water level recovery of the Lone Tree pit lake would occur in year 2012 for the No Action Alternative and in year ***2048*** for the Proposed Action (HCI 1995e).

## Potential Mitigation and Monitoring Measures

***See Appendix A in this FEIS for final mitigation measures.***

## Irreversible and Irretrievable Commitment of Resources

Total volume of groundwater removed by the Lone Tree Mine dewatering system during the period 1995 through 2006 would be approximately 1 million acre-feet; approximately 400,000 acre-feet would be removed as a result of the current mine plan where mining on private land only would end in year 1999. A small portion of this water would be consumed at the mine site and the remainder would be discharged to the Humboldt River. Addition of mine water to the Humboldt River would increase the load of some elements found in the discharge water to the hydrologic system (see Chapter 3, Water Resources).

Prior to entering the Humboldt River, a relatively small amount of discharge water would seep into the groundwater system beneath the cooling pond system and the lower portion of Herrin Slough. Some of the discharge water would also dissipate into the atmosphere due to evaporation, primarily at the cooling pond facility. Maximum evaporation rate from the Stage 1 cooling pond system (206 acres) would be approximately 720 acre-feet per year (450 gpm or 1.0 cfs) based on an annual net evaporation rate of 3.5 feet. Evaporation would also occur indefinitely from the Lone Tree Mine pit lake after mining ceases. The maximum evaporation rate from this body of water (***280*** acres) would be approximately ***840*** acre-feet per year (***520*** gpm or ***1.2*** cfs) based on a net evaporation rate of 3.0 feet per year.

During the dewatering period, the groundwater table would be lowered within the cone of depression, resulting in a reduction or elimination of flow in five springs and a portion of the Humboldt River. These water sources, however, would eventually recover and approach pre-mining conditions. These impacts of evaporation and reduction in flow at spring sites would also occur for authorized mining on private land. The Proposed Action would generally increase the duration of these impacts.

## Residual Adverse Effects

As discussed above, the Lone Tree Mine pit lake would be a continuous source of groundwater loss due to evaporation. In the long-term, water in the pit lake would not be acidic, but would have concentrations of ***some elements that exceed drinking water standards. These elements would impact***

***distance of less than 100 feet (from north and east sides of Lone Tree Hill).*** Eventual recovery of the groundwater table after dewatering ceases would allow impacts on springs, seeps, and the Humboldt River to diminish. Although the period required to reach steady-state conditions could be ***160*** years, most recovery is predicted to occur within about ***42*** years after cessation of dewatering.

# CHAPTER 4 - CULTURAL RESOURCES

Bold and Italics Indicate Revisions Made to the DEIS

# CULTURAL RESOURCES

## Summary

*A total of **three** cultural resource sites have been recorded in the Area of Potential Effect (APE). **None** of these sites are eligible for inclusion in the National Register of Historic Places (NRHP). The Proposed Action would destroy **three** cultural sites; however, none of these are eligible for listing on the NRHP.*

*Impacts on springs and their associated cultural and spiritual values to the Newe/Western Shoshone have occurred from loss of spring flows and riparian vegetation at five spring sites in the vicinity of the Lone Tree Mine site. Cessation of spring flows and loss of riparian vegetation probably has been caused by drawdown of the groundwater table from mine dewatering and/or a period of below-average precipitation. Although these impacts have occurred under existing mining conditions, loss of spring flows and associated cultural values and resources would be extended for the Proposed Action.*

## Direct and Indirect Impacts

### Proposed Action

***Direct impacts to three cultural resources (sites CrNV-22-5162, CrNV-22-5282, and CrNV-22-5563) would occur as a result of mine expansion. None of the impacted sites are National Register eligible. Therefore, their loss is not considered to be a significant impact, and does not prompt the need for avoidance or data recovery. Two properties eligible to the National Register under Criterion A are located just outside the APE. Site CrNV-22-5544 is located immediately adjacent to the I-80 right-of-way, while site CrNV-22-5556 is located adjacent to the existing Lone Tree Mine access road (which is adjacent to the I-80 corridor). The Proposed Action would not cause an impact to the setting or general integrity of these sites beyond what has occurred previously due to presence of the existing mining operation or the I-80 corridor.***

***Indirect impacts may occur to cultural resources located around the periphery of the Proposed Action. Such impacts may occur due to increased human presence in areas surrounding the project area, an increased duration of human presence in the general area as a whole, improved access into areas containing cultural resources, and changes in vegetation patterns around springs. In each case, cultural resources would become more vulnerable to illegal and/or unauthorized collection, and deliberate or accidental disturbance.***

***Concerns have been expressed by the Newe/Western Shoshone with regard to the Proposed Action. While consultation activities conducted to date have not resulted in the identification of traditional cultural properties within or immediately adjacent to the APE, dewatering and its effects on springs, plants, and animals are of concern. Within the last several years, five area springs have ceased flowing (i.e., Brooks, Planck, Stonehouse, Treaty Hill, and Hot Pot), their associated wetland and riparian vegetation has become desiccated, and early stages of upland plant succession are occurring. Of these, Treaty Hill, Stonehouse, and Planck springs were traditional camp areas, and Hot Pot Springs continues to have spiritual values for the Western Shoshone. Although the cause of lost spring flow is not known, groundwater drawdown from the cone of depression and/or below-average precipitation are believed to be factors. Planck and Stonehouse springs were reportedly dry in 1990 which is prior to initiation of dewatering at the Lone Tree Mine.***

***The Proposed Action would not increase the rate of dewatering, but would extend the duration of that activity by 7 years. This would, in turn, prolong impacts to the springs identified by Native Americans as being of value. Reestablishment of groundwater, spring flows, riparian vegetation, and associated wildlife habitat may require as much as 160 years once dewatering is terminated. If dewatering was prolonged by 7 years, then the onset of this recuperative process would be deferred for the same period of time. Based on predictive modeling, the Proposed Action would not affect additional springs beyond those already affected. The Proposed Action would, therefore, have some level of incremental impact on resources that convey traditional and spiritual values to Newe/Western Shoshone.***

During consultation, the Newe/Western Shoshone expressed concerns that the Proposed Action would affect wildlife presence and use of habitat in the vicinity of mine facilities. They also expressed concerns that sloughs and riparian areas along the Humboldt River would become drier, adversely affecting plants traditionally collected for food and medicine.

Although some species of wildlife and their habitats would be adversely affected by the Proposed Action, these impacts are predicted to be localized and negligible to regional wildlife populations. Following mining and reclamation, wildlife is predicted to resume use of affected habitat. Patterns of use would change because of the presence of the pit lake and altered topography but, overall abundance and diversity would approach or exceed pre-mining levels.

Vegetation at sloughs and along the Humboldt River is not predicted to be affected by reduced water availability. Under existing conditions, flows in the sloughs are intermittent in response primarily to precipitation during the growing season and this would not change with the Proposed Action. Downstream from the Iron Point Relief Canal, however, increased stream flows in the Herrin Slough and Humboldt River would have a minor beneficial impact on plants of potential traditional value to the Newe/Western Shoshone (see Vegetation section in this chapter).

## No Action Alternative

***Inventories have been conducted of most of the existing operation. Only the northern two-thirds of the cooling pond area have not been examined. If cultural resources are present in the Phase 2 or 3 cooling pond area, then some or all of those resources may be impacted during construction of those ponds. Aside from this possibility, the No-Action Alternative would have no additional impact on cultural resources beyond what has occurred to date.***

***Indirect impacts to cultural resources due to the No-Action Alternative would be similar in kind to those described for the Proposed Action, but would not occur over as long a duration. Under the No-Action Alternative, mining activities would terminate 7 years prior to when they would end if the Proposed Action was implemented.***

***Concerns expressed by the Newe/Western Shoshone are in response to impacts to springs that may be associated with the existing operation. The No-Action Alternative would not result in a reduction of the maximum dewatering rate. The duration of dewatering would continue through the term of the current mine plan (1999). The No-Action Alternative would not, therefore, have any additional impact on resources that convey traditional and spiritual values to Newe/Western Shoshone, beyond what has been authorized to date.***

## Potential Mitigation and Monitoring Measures

***See Appendix A in this FEIS for final mitigation measures.***

## Irreversible and Irretrievable Commitment of Resources

Cultural resources cannot be replaced. Therefore, disturbances that result in their destruction would constitute an irretrievable commitment of resources.

The Proposed Action would lengthen the period of dewatering of springs for at least 7 years. Continuation of the dewatering program would be an adverse effect on traditional values and practices of the Western Shoshone, and it is possible that the healing and spiritual properties of some of these springs would not be restored, resulting in an irretrievable loss.

## Residual Adverse Effects

Residual adverse effects on Newe/Western Shoshone traditional values, practices, properties, and cultural items are expected as a result of the Proposed Action. The primary adverse effect would be the extended loss of certain plant species at some springs from dewatering and the associated loss of the healing and spiritual nature of some springs. The effected springs, however, have already ceased flowing in the vicinity of the lone Tree Mine. The adverse effect could possibly be mitigated by replanting the spring areas with traditional plant species once water flow is re-established.

## Cultural Resources (Cumulative Effects)

***Existing Lone Tree mining operations have impacted 21 cultural resources. In the mine area, impacts have occurred to National Register eligible sites CrNV-22-5544, -5546, and -5556, all historic period sites located along the old Central Pacific Railroad grade. Impacts also have occurred to historic period debris scatters CrNV-22-5159 and -5281, and small prehistoric lithic scatters CrNV-22-6421, -6422, and -6424, all of which have been determined not to be National Register eligible. Finally, an impact has occurred to CrNV-22-5558, a historic period debris scatter (with features) for which no eligibility determination has been made. Construction of the pipeline and cooling pond has impacted large prehistoric lithic scatters P/L-8 and -10, both of which were recommended as National Register eligible by Hause (1994). Impacts also have occurred to site P/L-11, a prehistoric lithic scatter which was recommended for further evaluation by Hause (1994). Several prehistoric lithic scatters recommended as not eligible to the National Register were impacted. These include sites CrNV-22-3302, -3303, -3304, -3305, -3306, and -3307 (Ataman 1995), and sites P/L-5, -6, and -7 (Hause 1994).***

As depicted in **Figure 4-12**, the cumulative effects area for cultural resources and ethnography consists of approximately 2,500 square miles - an area that includes the Humboldt drainage between Winnemucca and Battle Mountain. Seventeen mines are currently operating within this area.

Mining activity in the cumulative effects area has resulted in approximately 10,394 acres of surface disturbance to date. It is projected that an additional 8,000 acres of mining-related surface disturbance will occur by year 2006. This would result in loss of an estimated 104 sites, 16 of which would be potentially NRHP-eligible.

Cultural resource inventories have been completed over most of these mining areas and consequently, cultural resources have been documented and sites evaluated as to their significance in terms of the National Register of Historic Places. Eligible sites have been avoided or impact to them mitigated either through data recovery or other negotiated means.

Cumulative impacts to cultural resources include disturbance of sites from constructing and mining activities, vandalism of sites, and increased access to sites.

The cumulative effects of mining to Newe/Western Shoshone traditional values and practices, properties, human remains and cultural items is adverse. The most serious impact is from dewatering springs which causes changes in vegetation, alteration of faunal use and cessation of traditional practices--all of concern to the Western Shoshone. Because water sources are important to desert environments and thus to the traditional values and practices of its people, the cumulative effects of dewatering springs and seeps are considered important. However, when water is restored to the springs and native vegetation is re-established, adverse effects resulting from dewatering practices would be reduced.

# ERRATA -- REVISED TABLES

| TABLE 1-2 (continued) Issues and Concerns Identified in Scoping | |
|---|---|
| **Issues** | **EIS Document Section(s)** |
| **Toxic and Hazardous Chemicals** | |
| Impacts and the reversibility of impacts from the failure of solution-containment systems. | Chapter 4 - Water Resources pp. - 4-30 and 4-31 |
| Potential for the release of cyanide or other contaminants into the soil, groundwater, and surface water to decompose to free cyanide. | Chapter 4 - Water Resources pp. - 4-30 and 4-31 |
| Potential impacts of hazardous materials on wildlife. | Chapter 4 - Terrestrial Wildlife pp. - 4-39 and 4-40 |
| **Permits and Regulatory Compliance** | |
| Discharge of dewatering fluids requiring a wastewater permit. | Chapter 2 - Existing Operations pp. - 2-4 |
| Amounts of fill that would be placed in Waters of the United States or jurisdictional wetlands. Involvement of Corps of Engineers and requirements for 404 Permit. | *Chapter 4 - Vegetation pp. - 4-45* |
| Measures to ensure compliance with RCRA regulations. | Chapter 2 - Existing Operations pp. - 2-22 |
| The unlawful killing of migratory birds and permits issued to allow migratory birds to be killed by toxic wastewater. | Beyond the scope of this document. |
| The requirement for a State of Nevada reclamation permit in 1993. The inclusion of the plan for this permit in the EIS. | Chapter 1 - Authorizing Actions pp. - 1-1<br>Chapter 2 - Proposed Operations pp. - 2-31 |
| Project planning with the COE, BuRec, Bureau of Water Quality Planning, and Bureau of Water Pollution Control to ensure water quality and beneficial uses are maintained. | Beyond the scope of this document. See Table 1-1. |
| Placement of the Environmental Protection Agency, Region IX, on the mailing list for comments. | Chapter 5 - Consultation and Coordination |
| **Noise** | |
| Impacts of noise from mining on wildlife. | Chapter 4 - Terrestrial Wildlife pp. - 4-39 through 4-41 |
| The influence of high noise levels on the ability of wildlife, especially birds, to detect their mates, young, and predators. | Chapter 4 - Terrestrial Wildlife pp. - 4-39 through 4-41 |
| Reduction of reproductive success by noise and potential decline in local wildlife populations. | Chapter 4 - Terrestrial Wildlife pp. - 4-39 through 4-41 |
| **Air Quality** | |
| Impacts on air quality from particulate and dust emissions from mining and ore processing, as well as from fugitive dust resulting from loss of vegetative cover. | Chapter 4 - Air Resources pp. - 4-5 |
| Potential impacts on Class I PSD areas, including visibility impacts. | Chapter 4 - Air Resources pp. - 4-6 |

| TABLE 2-2<br>Meteoric Water Mobility Procedure Results<br>Tailing Composite Samples | | | |
|---|---|---|---|
| Parameter[1] | Sample I | Sample II | Drinking Water Standard (MCL)[2] |
| pH (s.u.) | 9.3 | 9.64 | 6.5 - 8.5 |
| Total Dissolved Solids | 2,580 | 2,600 | 500 - 1,000 |
| Chloride | 75 | 82 | 250 - 400 |
| Fluoride | 0.3 | 0.2 | 2.0 - 4.0 |
| Nitrate as N | <0.1 | <0.1 | 10 |
| Sulfate | 1,580 | 1,550 | 250 - 500 |
| WAD Cyanide | 4.7 | 5.0 | 0.2[3] |
| Arsenic | 0.18 | 0.16 | 0.05 |
| Barium | 0.01 | 0.02 | [illegible] |
| Cadmium | <0.005 | <0.005 | 0.005 |
| Chromium | <0.01 | <0.01 | 0.1 |
| Copper | 3.76 | 3.11 | 1.3 |
| Iron | 0.18 | 0.16 | 0.3 - 0.6 |
| Lead | <0.05 | <0.05 | 0.015 |
| Magnesium | 1.6 | [illegible].2 | --- |
| Manganese | <0.01 | <0.01 | 0.05 - 0.1 |
| Mercury | <0.0003 | <0.0003 | 0.002 |
| Selenium | <0.03 | <0.03 | 0.05 |
| Silver | <0.01 | <0.01 | 0.1 |
| Zinc | <0.01 | <0.01 | 5.0 |

[1] All concentrations in milligrams per liter unless otherwise noted.
[2] Nevada State Drinking Water Standards (NAC 445A.119; 445A.144; 445A.453; 445A.455).
[3] Standard of 0.2 mg/L is for total cyanide.

Source: WESTEC 1994.

| TABLE 3-10<br>Water Quality Criteria and Standards for Nevada | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Drinking Water Std. | | | Aquatic Life[4] | | Agriculture | | |
| Parameter[1] (mg/L) | Primary | Secondary[2] | Municipal or Domestic Supply | 1-Hr Average or Propagation | 96-Hr Average or Put and Take | Irrigation | Stock Water | Wildlife Propagation |
| Aluminum | -- | 0.05-0.2 | -- | -- | -- | -- | -- | -- |
| Antimony | 0.006 | -- | 0.146 | -- | -- | -- | -- | -- |
| Arsenic | 0.05 | -- | 0.05 | 0.342 As(III) | 0.180 As(III) | 0.1 | 0.2 | -- |
| Barium | 2.0 | -- | 2.0 | -- | -- | -- | -- | -- |
| Beryllium | 0.004 | -- | 0 | -- | -- | 0.1 | -- | -- |
| Boron | -- | -- | -- | -- | -- | 0.75 | 5.0 | -- |
| Cadmium | 0.006 | -- | 0.005 | [3] | [3] | 0.01 | 0.05 | -- |
| Chromium (total) | 0.10 | -- | 0.10 | [3] Cr(III)<br>0.015 Cr(VI) | [3] Cr(III)<br>0.010 Cr(VI) | 0.1 | 1.0 | -- |
| Copper | 1.3[5] | 1.0 | -- | [3] | [3] | 0.2 | 0.5 | -- |
| Iron | -- | 0.3[0.6] | -- | 1.0 | 1.0 | 5.0 | -- | -- |
| Lead | 0.015[5] | -- | 0.05 | [3] | [3] | 5.0 | 0.1 | -- |
| Manganese | -- | 0.05[0.1] | -- | -- | -- | 0.2 | -- | -- |
| Mercury | 0.002 | -- | 0.002 | 0.002 | .000012 | -- | 0.01 | -- |
| Molybdenum | -- | -- | -- | 0.019 | 0.019 | -- | -- | -- |
| Nickel | 0.1 | -- | 0.0134 | [3] | [3] | 0.2 | -- | -- |
| Selenium | 0.05 | -- | 0.05 | 0.020 | 0.005 | 0.02 | 0.05 | -- |
| Silver | -- | 0.1 | -- | [3] | [3] | -- | -- | -- |
| Thallium | 0.002 | -- | 0.013 | -- | -- | -- | -- | -- |
| Zinc | -- | 5.0 | -- | [3] | [3] | 2.0 | 25.0 | -- |
| Alkalinity | -- | -- | -- | less than 25% change | | -- | -- | 30-130 |
| Chloride | -- | 250[400] | 250[400] | -- | -- | -- | 1,500 | 1,500 |
| Color (PCU) | -- | 15 | 75 | -- | -- | -- | -- | -- |
| Cyanide | 0.2 | -- | 0.2 | 0.022 | 0.0052 | -- | -- | -- |
| Dissolved Oxygen | -- | -- | Aerobic | >5.0 | >5.0 | -- | Aerobic | Aerobic |
| Fluoride | 4.0 | 2.0 | -- | -- | -- | 1.0 | 2.0 | -- |
| Magnesium | -- | 125[150] | -- | -- | -- | -- | -- | -- |
| Nitrate as N | 10 | -- | 10 | 90(w) | 90(w) | -- | 100 | 100 |
| pH (SU) | -- | 6.5-8.5 | 5.0-9.0 | 6.5-9.0 | 6.5-9.0 | 4.5-9.0 | 5.0-9.0 | 7.0-9.2 |
| Phosphates | -- | -- | Site specific determination | | | -- | -- | -- |
| Sulfate | -- | 250[500] | 250[500] | -- | -- | -- | -- | -- |
| Sulfide | -- | -- | -- | 0.002 | 0.002 | -- | -- | -- |
| Temp° C | -- | -- | -- | Site specific determination | | -- | -- | -- |
| TDS | -- | 500[1,000] | 500[1,000] | -- | -- | -- | 3,000 | -- |
| TSS | -- | -- | -- | 25-80 | 25-80 | -- | -- | -- |
| Turbidity (NTU) | 1.0-5.0 | -- | -- | 50(w);10(c) | 50(w);10(c) | -- | -- | -- |

[1] mg/L = milligrams per liter; PCU = photoelectric color units; SU = standard pH units; NTU = nephelometric turbidity units; TDS = total dissolved solids; TSS = total suspended solids; °C = degrees Celsius. Standards for metals are expressed as total recoverable, except for most of the aquatic life standards which apply to the dissolved fraction.
[2] Numbers in brackets [ ] are mandatory secondary standards for public water systems. Standards for aluminum and silver are secondary standards from USEPA (1995); Nevada has not adopted standards for aluminum and silver.
[3] Parameter dependent on hardness; see NAC 445A.144 for equations to determine concentration.
[4] (w) refers to warm water and (c) is for cold water. No letter designation indicates criteria are common to both warm and cold water.
[5] "Action levels" for copper and lead are exceeded if concentrations in more than 10% of tap water samples collected during any monitoring period are greater than 1.3 and 0.015 mg/L, respectively.

Source: NAC 445A.119; 445A.144; 445A.453; 445A.455.

| TABLE 3-11<br>Water Quality Standards for Humboldt River at Comus Gage Control Point | | |
|---|---|---|
| Parameter[1] (mg/L) | Water Quality Standards for Beneficial Uses[2] | Most Restrictive Beneficial Use |
| Temp (°C) | $\Delta T \leq 2°\,C$ [3] | Aquatic life (warm water fishery) |
| pH (SU) | 6.5 - 9.0 $\Delta pH \pm 0.5$ | Water contact recreation; wildlife propagation |
| Dissolved Oxygen | ≥ 5.0 | Aquatic life (warm water fishery) |
| Chlorides | ≤ 250 | Municipal or domestic supply |
| Total Phosphorous (as P) | ≤ 0.1 [4] | Aquatic life (warm water fishery) |
| Nitrogen Species (N) | Nitrate ≤ 10;<br>Nitrite ≤ 1.0;<br>Un-ionized Ammonia ≤ 0.02 | Municipal or domestic supply |
| TDS | ≤ 500 (annual average) | Municipal or domestic supply |
| TSS | ≤ 80 (annual median) | Aquatic life (warm water fishery) |
| Sodium (SAR) | ≤ 8 (annual average) | Irrigation |
| Color (PCU) | No adverse effects | Municipal or domestic supply |
| Turbidity (NTU) | ≤ 50 | Aquatic life (warm water fishery) |
| Sulfate | ≤ 250 | Municipal or domestic supply |

[1] mg/L = milligrams per liter; °C = degrees Celsius; SU = standard pH units; P = phosphorous; TDS = total dissolved solids; TSS = total suspended solids; SAR = sodium adsorption ratio; PCU = photoelectric color units; NTU = nephelometric turbidity units. Limits apply from the control point at Comus gage upstream to the Battle Mountain gage control point.

[2] Δ = change; all values are single-value measurements, unless otherwise noted.

[3] Maximum allowable change in temperature at the boundary of an approved mixing zone. ($\Delta T \leq 3.6°$ F).

[4] Seasonal average for April - November.

Source: NAC 445A.206.

**TABLE 3-12**
**Summary of Humboldt River Water Quality Data in Vicinity of Lone Tree Mine**

| Parameter[1] | Surface Water Station[2] | | Drinking Water Standards[3] | Battle Mtn and Comus Gages Control Point Standards[4] | Aquatic Life Standards[5] (chronic/acute) |
|---|---|---|---|---|---|
| | Battle Mtn Gage (1990-95) | Comus Gage (1990-95) | | | |
| Flow (cfs) | 0 - 876 | 0.04 - 539 | -- | -- | -- |
| Temp (°C) | -1.0 - 25.0 | -1.2 - 24.7 | -- | $\Delta T \leq 2°C$ | -- |
| TDS | 280 - 546 | 305 - 963 | 500 (s) | 500 | -- |
| SC (μmhos/cm) | 441 - 858 | 457 - 1490 | -- | -- | -- |
| TSS | 9 - 2776 | 7 - 550 | -- | 80 | 25 - 80 |
| Turbidity (NTU) | 7 - 742 | 8 - 255 | 1.0 | 80 | 10 |
| pH (SU) | 8.4 - 8.7 | 8.5 - 8.8 | 6.5 - 8.5 (s) | 7.0 - 9.0 | 6.5 - 9.0 |
| DO | 6.2 - 13.4 | 2.4 - 12.9 | -- | ≥ 5.0 | >5.0 |
| Sulfate ($SO_4$) | 48 - 74 | 49 - 191 | 250 (s) | -- | -- |
| Chloride (Cl) | 16 - 88 | 16 - 223 | 250 (s) | 250 | -- |
| Alkalinity | 142 - 248 | 172 - 374 | -- | -- | -- |
| Hardness | 174 - 205 | 126 - 195 | -- | -- | -- |
| Nitrate as N | 0.01 - 0.43 | 0.01 - 0.34 | 10 | 45 | 90 |
| Arsenic (As) | <0.003 - 0.012 | 0.009 - 0.037 | 0.05 | -- | 0.18/0.342 |
| Boron (B) | 0.100 - 0.300 | 0.200 - 0.900 | -- | -- | -- |
| Cadmium (Cd) | <0.001 - 0.002 | <0.001 - 0.003 | 0.005 | -- | 0.001/0.006 |
| Chromium (Cr) | <0.005 - 0.006 | <0.005 - 0.006 | 0.10 | -- | 0.010/0.015 |
| Copper (Cu) | 0.001 | <0.010 - 0.020 | 1.0 | -- | 0.016/0.026 |
| Iron (Fe) | 0.110 - 2.280 | 0.090 - 3.260 | 0.3 (s) | -- | 1.0 |
| Lead (Pb) | <0.005 - 0.015 | <0.005 - 0.019 | 0.015 | -- | 0.002/0.083 |
| Mercury (Hg) | <0.0005 | <0.0004 - 0.0006 | 0.002 | -- | 0.000012/0.002 |
| Selenium (Se) | <0.001 - 0.001 | <0.001 - 0.005 | 0.05 | -- | 0.005/0.02 |
| Zinc (Zn) | 0.010 | 0.010 - 0.040 | 5.0 (s) | -- | 0.145/0.160 |

1 All concentrations reported in milligrams per liter (mg/L) unless otherwise noted; DO = dissolved oxygen (field measured); TDS = Total Dissolved Solids; TSS = total suspended solids; SC = specific conductance; °C = degrees Celsius; SU = standard pH units (lab measured); NTU = nephelometric turbidity units.

2 See Figure 3-8 for Battle Mountain and Comus gage locations. The Battle Mountain gage samples were collected by the Nevada Division of Environmental Protection (NDEP) during 22 sampling episodes from February 1990 through November 1995. The Comus gage samples were collected by the NDEP during 25 sampling episodes from February 1990 through November 1995.

3 All concentrations reported are primary drinking water standards unless followed by an (s) indicating secondary standards (see NAC 445A.453 and 445A.455). Standards for copper and lead are "action levels." "--" means no standard.

4 Control point standards for Battle Mountain and Comus gage as listed in NAC 445A.205 and 445A.206, respectively. "--" means no standard.

5 Where applicable, both acute (1-hour average) and chronic (96-hour average) aquatic life standards were calculated for metals based on a "hardness" concentration of 175 mg/l (see NAC 445A.144). "--" means no standard.

Source: NDEP; NAC 445A.119, 445A.144, 445A.205 & 445A.206.

## TABLE 3-19
## Summary of Groundwater Quality Data in Vicinity of Lone Tree Mine

| Parameter[1] | Groundwater Well and Concentration Ranges[2] | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | M/O 11-2 | OW-9A | M/O 35-19-1B | WW-4 | WW-2 | WW-12 | WW-5 | WW-10 | Drinking Water Stds[3] |
| Geologic Unit | Alluvium | Alluvium | Alluvium | Valmy | Havallah | Havallah | Wayne Zone | Wayne Zone | -- |
| Date Sampled | 5-2-95 | 5-3-95 | 4-24-95 | 3-9-91 | 9-18-95 | 9-18-95 | 9-28-93 | 9-18-95 | -- |
| Temp (°C) | -- | -- | -- | 29°C | 32°C | 32°C | 33°C | 37°C | -- |
| SC ($\mu$mhos/cm) | -- | -- | -- | 690 | 525 | 681 | 837 | 784 | -- |
| TDS | 590 | 1,200 | 1,120 | 430 | 381 | 420 | -- | 516 | 500 (s) |
| pH (SU) | 8.0 | 7.9 | 8.3 | 7.2 | 7.4 | 6.9 | 6.8 | 7.3 | 6.5-8.5 (s) |
| Alkalinity | 459 | 450 | 901 | 297 | 313 | 304 | 299 | 412 | -- |
| Sulfate ($SO_4$) | 54 | 169 | 50 | 48 | 39 | 64 | 37 | 46 | 250 (s) |
| Chloride (Cl) | 20 | 279 | 50 | 20 | 20 | 18 | 17 | 20 | 250 (s) |
| Fluoride | 1.4 | 3.3 | 4.3 | -- | 1.5 | 2.2 | 2.5 | 2.5 | 4 (s) |
| Nitrate ($NO_3$-N) | <0.02 | <0.02 | <0.02 | 1.0 | 0.06 | <0.02 | <0.1 | <0.02 | 10 |
| Antimony | <0.1 | <0.1 | <0.001 | -- | <0.1 | <0.1 | <0.1 | <0.1 | 0.006 |
| Arsenic (As) | 0.007 | 0.019 | 0.075 | 0.037 | 0.002 | 0.168 | <0.005 | 0.064 | 0.05 |
| Barium (Ba) | 0.098 | 0.076 | 0.010 | <0.3 | -- | -- | -- | -- | 2.0 |
| Cadmium (Cd) | <0.002 | <0.002 | <0.002 | <0.0005 | <0.0019 | <0.0019 | <0.01 | 0.003 | 0.005 |
| Chromium (Cr) | <.003 | 0.019 | <0.003 | <0.02 | -- | -- | <0.05 | -- | 0.10 |
| Copper (Cu) | <0.003 | <0.003 | <0.003 | <0.02 | <0.0017 | <0.0017 | <0.2 | <0.0017 | 1.3 |
| Iron (Fe) | 0.197 | 8.13 | 0.123 | 0.76 | <0.011 | 3.21 | 0.15 | 0.673 | 0.3 (s) |
| Lead (Pb) | <0.04 | <0.04 | <0.04 | <0.003 | <0.032 | <0.032 | <0.5 | <0.032 | 0.0[illegible] |
| Manganese (Mn) | 0.013 | 0.359 | 0.03 | 0.11 | <0.0009 | 0.128 | 6.8 | 0.121 | 0.05 (s) |
| Mercury (Hg) | <0.0002 | <0.0002 | <0.0002 | <0.0005 | <0.0002 | <0.0002 | <0.0005 | <0.0002 | 0.002 |
| Nickel (Ni) | <0.021 | <0.021 | <0.021 | -- | -- | -- | <0.4 | -- | -- |
| Selenium (Se) | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | 0.05 |
| Silver (Ag) | <0.002 | <0.002 | <0.002 | <0.001 | <0.0022 | <0.021 | <0.02 | <0.0022 | -- |
| Zinc (Zn) | 0.0028 | 0.034 | <0.002 | 0.01 | 0.0049 | 0.052 | 0.05 | 0.0035 | 5.0 (s) |

[1] All concentrations reported in milligrams per liter (mg/L) unless otherwise noted; TDS = total dissolved solids; SC = specific conductance; °C = degrees Celsius; SU = standard pH units (lab measured).

[2] See Figure 3-13 for well locations; "--" means no analysis.

[3] All concentrations reported are primary drinking water standards unless followed by (s) indicating secondary standards (see NAC 445A.453 and 445A.455). Standards for copper and lead are "action levels". "--" means no standard.

Source: NAC 445A.453 and 445A.455; Sierra Pacific Power Company 1975; Hydro-Search, Inc. 1991a, 1991b; PTI 1994; LTM 1995.

**TABLE 3-20**
**Summary of Mine Dewatering Discharge Water Quality**

| Parameter[1] | Discharge Concentration[2] | | | | | | |
|---|---|---|---|---|---|---|---|
| | 1995 1st Quarter | 1995 2nd Quarter | 1994 3rd Quarter | 1994 4th Quarter | Permit[3] Requirement | Comus Gage Control Std.[4] | Aquatic Life Std.[5] |
| Maximum Flow (mgd) | 31.3 - 38.8 | 37.9 - 39.6 | 29.5 - 36.4 | 21.9 - 26.1 | 135 | --- | --- |
| Total Dissolved Solids | 419 - 475 | 453 - 462 | 430 - 465 | 408 - 437 | 560 | 500 | --- |
| Total Suspended Solids | <0.1 - 19 | 2 - 6 | 4 - 10 | 1 - 4 | 30 | 80 | 25 - 80 |
| Turbidity (NTU) | 1.5 - 2.2 | 2.7 - 15.3 | 0.8 - 1.8 | 0.9 - 1.7 | 50 | 80 | 10 |
| pH (SU) | 7.7 - 8.2 | 7.7 - 8.0 | 7.7 - 8.0 | 7.7 - 7.9 | 7.0 - 8.5 | 6.5 - 9.0 | 6.5 - 9.0 |
| Temperature (°C)[6] | 3-5; 11-11 | NM | 27 - 29 | NF | ▵ 2°C | ▵ 2°C | ss |
| Dissolved Oxygen | --- | 6.05 * | --- | --- | ≥ 5.0 | ≥ 5.0 | --- |
| Sodium Adsorption Ratio | --- | 4.6 * | --- | --- | 8.0 | 8.0 | --- |
| Total Nitrogen | .51 - 1.0 | .93 - 1.17 | .4 - .73 | .732 - .193 | 3.7 | --- | --- |
| Nitrate (as N) | .12 - .21 | .08 - .11 | .08 - .14 | .09 - .12 | 10 | 10 | 90 |
| Nitrite (as N) | .03 - .04 | <0.02 | --- | 0.03 | 1.0 | 1.0 | --- |
| Ammonia (as N; unionized) | --- | --- | --- | --- | 0.02 | 0.02 | --- |
| Total Phosphorous (as P) | .010 - .590 | .02 - .05 | <.01 - .06 | <.01 - .047 | 0.1 | 0.1 | ss |
| Chloride (Cl) | 17 - 19 | 18 - 19 | 18 - 19 | 17 - 18 | 110 | 250 | --- |
| Sulfate (SO4) | --- | 43 * | --- | --- | 250 | 250 | --- |
| Arsenic (As) | .030 - .096 | .071 - .097 | .017 - .028 | .013 - .035 | 0.05 | --- | .342 |
| Boron (B) | --- | --- | --- | --- | 0.05 | --- | --- |
| Copper (Cu) | <.002 - .011 | <.003 - .0032 | <.002 - .008 | <.002 - .009 | 0.021 | --- | .016/.026 |
| Iron (Fe) | .209 - .598 | .421 - .930 | .36 - .60 | 0.30 - 1.4 | 1.0 | --- | 1.0 |
| Lead (Pb) | <.001 - .002 | <.001 | .001 - .002 | .002 | 0.11 | --- | .002/.083 |
| Manganese (Mn) | .041 - .104 | .066 - .097 | .07 - .08 | .07 - .10 | 0.2 | --- | --- |
| Zinc (Zn) | .0067 - .029 | .011 - .029 | <.005 - .03 | <.004 - .011 | 0.14 | --- | .145/.160 |
| Cyanide (Total) | <.0026 - <.004 | <.004 - <.005 | <.004 - <.005 | <.004 - <.005 | 0.022 | --- | .0052/.022 |
| Total Petroleum Hydrocarbons (TPH) | <0.5 | <0.5 | <0.5 | <0.5 | 1.0 | --- | --- |

[1] mgd = million gallons per day (average for month); NTU = nephelometric turbidity units; SU = standard units; °C = degrees Celsius; WAD = weak acid dissociable.

[2] Concentration ranges are monthly reports of maximum values in mg/L unless otherwise specified; permit requirement also is based on the maximum concentrations detected; temperature values are changes over background in Humboldt River; NF = no flow at sample point; NM = not measured due to flooding conditions.

[3] Permit is NPDES No. NV0021962 from NDEP; effective date is November 8, 1995. Values are daily maximum limitations for discharge.

[4] Water quality standards for Humboldt River at the Comus gage control point (NAC 445A.206).

[5] ss = site-specific determination (see NAC 445A.119); aquatic life standards (chronic/acute) for Cu, Pb, and Zn are calculated based on hardness value of 175 mg/L for the Humboldt River (see NAC 445A.144).

[6] First number of pair is water temperature of Humboldt River upstream of discharge point; second number of pair is river temperature downstream of discharge permit; temperature standard not implemented until 1994; ▵ 2°C means that discharge water cannot change temperature of Humboldt River by more than 2°C.

* Data for December 1995 used because previous data for these parameters were not obtained.

Source: LTM 1994c, 1995.

TABLE 4-7
Existing and Reasonably Foreseeable Mining Disturbance in the Lone Tree Cumulative Effects Area

| Map Reference Number | Facility Name and Company | Currently Permitted (acres) | Status and Proposed Disturbance (acres) | Total Proposed and Existing (acres) | Comments | Source of Proposed Disturbance Information |
|---|---|---|---|---|---|---|
| 1 | **Twin Creeks Mine** Santa Fe Pacific Gold | 4,144 | expanding; approximately 5,856 proposed | 10,000 (approx) | 750 employed. Projected employment: 600 for construction; 200 for operations | BLM Jan. 1994; Howell 1993; SFPG 1994b; Herrick 1994; Loda 1994 |
| 2 | **Getchell Mine** First Miss Gold Inc. | 1,716 | active | 1,716 | 140 employed; started 1989; 150,000 oz Au/yr; mine life remaining: 7 years. | BLM Jan. 1994; Howell 1993; Herrick 1994 |
| 3 | **Pinson Mine** Pinson Mining Co.* | 918 | active | 918 | 130 employed; started 1981; 54,000 oz Au/yr; mine life remaining: 5 years. | BLM Jan. 1994; Howell 1993; Herrick 1994 |
| 7 | **Preble Mine** Pinson Mining Co.* | 214 | inactive | 214 | produced 17,000 oz Au/yr; 113 acres reclaimed | BLM Jan. 1994; Herrick 1994 |
| 5 | **Kramer Hill Mine** Pinson Mining Co.* | 28.9 | closed | 28.9 | reclaimed 23.1 acres in 1993 | BLM Jan. 1994; Herrick 1994 |
| 6 | **Silver Hills Mine** Horton Mining Co. | 4.9 | abandoned | 4.9 | small heap leach; 0 acres reclaimed | BLM Jan. 1994; Herrick 1994 |
| 7 | **Adelaide Crown** Icarus Exploration | 90.6 | inactive | 90.6 | 1 employee; temp shut down; 0 acres reclaimed | BLM Jan.1994; Herrick 1994 |
| 8 | **Lone Tree Mine** Santa Fe Pacific Gold | 2,059.1 | expanding; 1,491.0 proposed | 3,550.1 | 350 employed; started operations in 1990 | BLM Jan. 1994; Howell 1993; SFPG 1994a |
| 9 | **Marigold Mine** Marigold Mining Co.** | 1,187 | active | 1,187 | 132 employed; started in 1989; 60,000 oz Au/yr; 65 acres reclaimed | BLM Jan.1994; Howell 1993; Herrick 1994 |
| 10 | **Big Mike Mine** Guthrie Nevada Corp. | 31.2 | inactive | 31.2 | copper leach; project on hold; 0 acres reclaimed | BLM Jan. 1994; Herrick 1994 |
| 11 | **Trenton Canyon** Santa Fe Pacific Gold | —— | geologic resource | > 640 | Exploration disturbance only; no mining disturbance to date | Young 1994 |
| 12 | **Battle Mountain Gold** Battle Mtn. Range Operations/Active | 3832 | 1969 (1293 disturbed) | 4508 | 350 employees during construction; 195 employees during operations | BLM, March 1995; Brown 1995 |
| 13 | **Santa Fe Pacific Gold** Argenta Exp/Active | 255 | 195 | 450 | 25 employees | BLM, March 1995; Brown 1995 |
| 14 | **Santa Fe Pacific Gold** Mule Canyon Mine/EIS Process | 0 | 2870 | 2870 | 300 employees during construction; 190 employees during operations | BLM, March 1995; Brown 1995 |
| 15 | **Baker Hughes-Intec** Argenta Barite Mine/Active | 604 | 0 | 604 | 25 employees | BLM March 1995; Brown 1995 |
| 16 | **Uranerz** Slave Canyon Exp./Inactive | 5 | 0<br>0 | 5<br>5 | 10 employees | BLM March 1995; Brown 1995 |
| 17 | **St. George Metals** Dean Underground Mine/Active Guthrie Nevada Corp. | 27 | 0<br>0 | 27<br>27 | 5 employees | BLM March 1995; Brown 1995 |
| **TOTAL** | | **15,116.7** | | **> 26,844.7** | | |

* Pinson Mining Company is a joint venture between Rayrock Resources, Homestake, and American Barrick.

** Marigold Mining Company is a joint venture between Rayrock Mines and Homestake.

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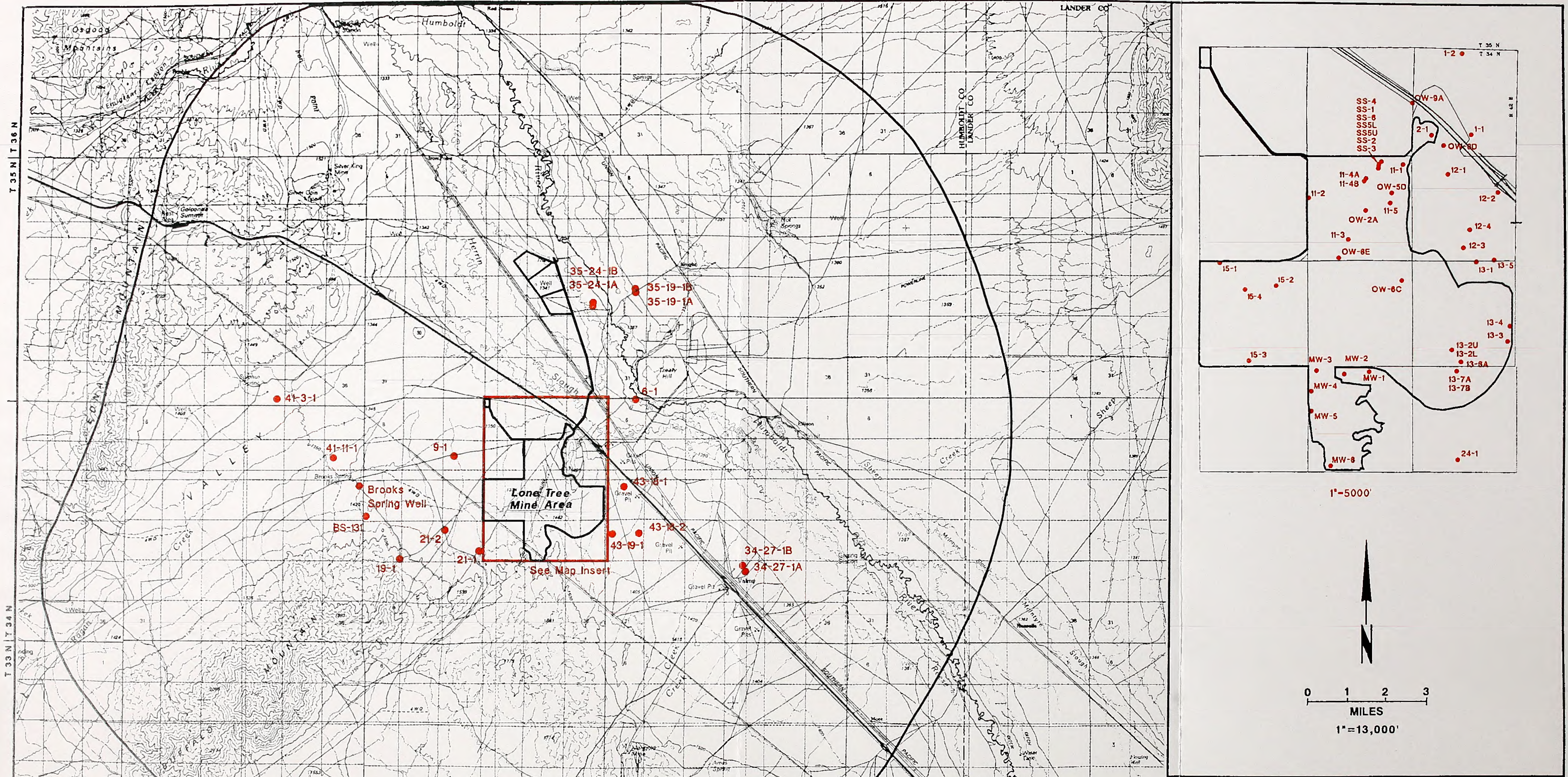
# ERRATA -- REVISED FIGURES




## LONE TREE MINE PROJECT

Groundwater Monitoring Wells

FIGURE 3-13

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# CHAPTER 4

# COMMENTS AND RESPONSES

This chapter includes copies of all public comments received in response to the Lone Tree Mine Expansion DEIS. The BLM's responses to substantive comments are provided adjacent to the reproduced comment letters. Seventeen comment letters were received on the DEIS. The comment period for the DEIS ended on February 16, 1996.

Two public meetings were held during the public comment period on the DEIS. One meeting was held on January 9, 1996 in Winnemucca and the second meeting was held on January 10, 1996. No comments were received by BLM at either public meeting.

The following is a listing of the 17 comment letters and the person(s), agency(ies), and/or group(s) responsible for preparation of the letters:

| | |
|---|---|
| Letter 1. | Scott Johnson, January 1, 1996. |
| Letter 2. | Sharon Harrer Sweeney, January 25, 1996. |
| Letter 3. | Kevin I. Roukey, Chief, Nevada Office Department of the Army, U.S. Army Engineer District, Corps of Engineers, February 5, 1996. |
| Letter 4. | Rebecca Lynn Palmer, Archaeologist, State of Nevada, Department of Museums, Library and Arts, State Historic Preservation Office, February 13, 1996. |
| Letter 5. | Deanna M. Wieman, Director, Office of External Affairs, U.S. EPA, Region IX, February 16, 1996. |
| Letter 6. | Tom Filbin, Manager IL Sheep Ranch, February 15, 1996. |
| Letter 7. | Glenn C. Miller, Chair of the Mining Committee, Toiyabe Chapter of Sierra Club, February 15, 1996. |
| Letter 8. | Carlos H. Mendoza, State Supervisor, Nevada State Office, USDA Fish and Wildlife Service, February 16, 1996. |
| Letter 9. | John S. Stein, Hydrologist.<br>Robert Brown, Woodward Properties, Ltd., February 12, 1996. |
| Letter 10. | Robert Rebholtze, Jr., Agri Beef Co., February 16, 1996. |
| Letter 11. | Jim Wilson, Legal and Safety Employer Research (LASER), Division of Western States Pipe Trades. |
| Cover Letter | Terri Rodefer, Environmental Advocate, State of Nevada, Nevada State Clearinghouse, Department of Administration, February 26, 1996. |

Letter 12. David R. Cowperthwaite, Clearinghouse Coordinator, State of Nevada, Department of Conservation and Natural Resources, Division of Environmental Protection, February 2, 1996.

Letter 13. Richard T. Heap, Jr. Regional Manager, Region I, State of Nevada, Department of Conservation and Natural Resources, Division of Wildlife, February 28, 1996.

Letter 14. Michael J. Anderson, P.E. Hydraulic Engineer III, State of Nevada, Department of Conservation and Natural Resources, Division of Wildlife, February 28, 1996.

Letter 15. Thomas J. Fronapfel, P.E., Assistant Director Planning, State of Nevada, Department of Transportation, March 1, 1996.

Letter 16. Bill Durbin, Chief, Bureau of Abandoned Mine Lands, State of Nevada, Department of Business and Industry, Division of Minerals, February 16, 1996.

Letter 17. James F. Devine, Senior Advisor for Science Applications, USDA U.S. Geological Survey, March 11, 1996.

# Letter #1

Scott Johnson
15 Eclipse Dr.
Sparks, Nv 89436

January 1, 1996

Gerald Moritz
EIS Project Manager - BLM
Winnemucca District Office
705 E. 4th Street
Winnemucca, NV 89445

Dear Mr. Moritz,

I would like to make some comments regarding the Draft EIS for the Lone Tree Mine proposed expansion.

First of all, this is a relatively concise document and was quite good. Too much time can be spent wading through excess verbiage!

Specifically, I have two detailed comments regarding proposed mitigation on page 4-3. They are:

1) "Capping potentially acid-producing overburden with low-permeability material (such as clay) prior to placement of non-acid generating caprock."

2) "Construction of compacted clay pads below overburden disposal facilities."

Regarding 1, it is doubtful that clay would deter root growth into the acid generating rock. It would slow water migration but that is a non-issue in this arid environment. A thicker cover (longer than root growth?) of oxide material alone should be more than adequate. The settling of the dumps may disrupt any barrier put in place.

Regarding 2, Why do this? There is a buffer of oxide rock laid down first along with the natural alkalinity of the existing alluvium. It is too dry for water and metal migration down through the dumps. I have been around some quite old waste dumps in the area, and they have not run water yet. The growth of plants on the dumps will also increase the drying effect beyond what I have seen.

Thank You,

Scott Johnson

**RESPONSE 1**

Comments noted.

# Letter #2

645 Prebble
Winnemucca, NV 89445
January 25, 1996

Gerald Moritz, EIS project manager
Bureau of Land Management
Winnemucca District Office
705 East Fourth Street
Winnemucca, NV 89445

Dear Sir;

After reading a copy of the EIS for the Lone Tree Expansion project I am appalled at the idea that an expansion would even be considered. The devastation already caused by this mine and all the others should be enough to stop all the current mines now and certainly not allow for future devastation.

I find the fact that most of the springs in the area are already dry due to mining very little cause to allow them to be dry for 7-10 more years so that mining and the rape of the land to continue. The wells and general water supply in this area is already in a very sorry state and might not EVER recover from more years of waste.

As for the town of Winnemucca, itself. THe influx of less than bright people to work in the mining industry has left the town with an excessive crime rate for a small town, overburdened sewer and water systems and generally more congestion than the town can handle. The only ones who are happy with the present and ongoing mess the town is in are greedy storekeepers and businesses who will do anything to make a buck regardless of what havoc it causes on the environment or the town it affects.

The reclamation plan to fill the pit with water is totally stupid in a lot of ways. I don't think that this plan will return the area to the exact state it was in pre-mining. However, I am sure that it is by far the cheapest solution for the mining company whether it really amounts to any reclamation or not.

The air quality has been affected by mining. The water quality has been all but ruined and the BLM is actually considering approving this expansion? I thought you were supposed to protect the environment, animals, water quality, etc. I guess that I was mistaken.

If you think that all miners are above reproach I would like to relate a story (biographical) about the past 2 years of my life. In April of 1994 we had the big misfortune of having a mining family move in next to us. I think if you combined all 5 of their IQ's you might have a bowl of soup. The man is one of the ones who work with cyanide at his particular mine. Smart choice, huh? Since day one they have annoyed us, harrassed us, made a mockery of the laws of the town and gotten away with repeated violations because THE MAN IS A MINER. That makes everything they do wonderful and leaves us treated like dog poop on the bottom of a shoe. Is this the kind of treatment longtime or lifelong residents can expect? Obviously so, as the miner and his money are far more important.

Winnemucca used to be a nice town before the gold fever struck. Now,

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as a home it is not fit to live in. Speaking of which, we are going to have to sell our home of nearly nine years to move out into the country so that we can experience a rare phenomenon in Winnemucca--peace and quiet.

Your EIS statement did not, I notice, point out what percentage of the unusually high crime rate is caused by miners. Those numbers are obviously kept under lock and key as they would surely be a very high percentage indeed.

Not only should this expansion be denied but any others that want to expand and put a further plague on this county and this city and state should be uncategorically denied at the earliest opportunity.

I am sure that my letter will be brushed aside as usual. I, however, can positively guarantee you that I care more about the environment and the state of our future than any of the mining companies or their employees ever will. The devastation is nearly complete so stop the mining now while there is still at least a glimmer of hope for a promising future for this area.

Thank you for your time.

Sincerely yours,

Sharon Harrer Sweeney

Sharon Harrer Sweeney

P.S. If possible I would like copies of the other letters you received in reponse to this proposal.

**RESPONSE 2**

Comments noted.

# Letter #3

DEPARTMENT OF THE ARMY
U.S. ARMY ENGINEER DISTRICT, SACRAMENTO
CORPS OF ENGINEERS
1325 J STREET
SACRAMENTO, CALIFORNIA 95814-2922

REPLY TO
ATTENTION OF

February 5, 1996

Regulatory Branch (199400687)(FEC)

U.S. Bureau of Land Management
ATTN: Gerald Moritz, EIS Project Manager
Winnemucca District Office
705 East 4th Street
Winnemucca, Nevada 89445

Dear Mr. Moritz:

I am responding to the Draft Environmental Impact Statement (DEIS) for SANTA FE PACIFIC GOLD COMPANY - LONE TREE MINE EXPANSION PROJECT located in portions of Sections 11, 13, 15, and 23, Township 34 North, Range 42 East, within HUMBOLDT County, Nevada.

The Corps of Engineers jurisdiction within the study areas is under the authority of Section 404 of the Clean Water Act for the discharge of dredged or fill material into waters of the United States or excavation that has more than minimal effect on the aquatic environment in these waters. Waters of the United States include, but are not limited to, the following: perennial and intermittent streams, lakes, ponds, as well as wetlands in marshes, wet meadows, and side hill seeps. Project features that would occur from development within the study areas that result in the discharge of fill material into waters of the United States will require Department of the Army authorization prior to initiating work.

3A The range of alternatives considered in an EIS should include alternatives to fill in wetlands or other waters of the United States within the study area. Every effort should be made to avoid project features which require the discharge of fill into waters of the United States. In the event it can be clearly demonstrated there are no practicable alternatives to filling waters of the United States, mitigation plans should be developed to compensate for the losses resulting from project implementation.

Due to staff limitations, we are unable to provide a comprehensive review of the DEIS. However, we have provided the following comments pertaining to Section 404 of the Clean Water Act.

**RESPONSE 3A**

Because the total disturbance to wetlands and other Waters of the U.S. (WUS) for the Proposed Action would be less than 1.0 acre (0.0 acres of wetlands; 0.4 acres WUS on public land; 0.4 acre of WUS on private land), no significant impact was identified for which an alternative was considered. Mitigation for filling of narrow, incised drainages would include stabilizing fill material to minimize erosion and routing stormwater around these areas.

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3B a) Page 1-9 (Table 1-2): In the section headed PERMITS AND REGULATORY COMPLIANCE, the references pertaining to "Amounts of fill that would be placed in Waters of the United States or jurisdictional wetlands. Involvement of Corps of Engineers and requirement s for 404 Permit" - Chapter 2 Existing Operations pp. 2-17 and Chapter 4 - Vegetation pp.- 4-36. Page 2-17 is a FIGURE 2-6 and there are no references to impacts due to fills in waters of the U.S. and page 4-36 references Impacts from Pit Water Recovery and Impacts on Surface Water Quality. These discrepancies should be clarified.

3C b) Pages 3-73 & 3-76 make reference to studies prepared by Gibson and Skordal(1993) and Culwell and Elliot(1994) regarding the identification of wetlands. The Corps of Engineers has not verified and wetlands or jurisdictional delineations for the project site. Although we reviewed the Gibson & Skordal Delineation Report, it has never been formally submitted for verification. As a result of that review we determined that there has been previous impact to waters of the United States at the Lone Tree Mine and through meetings with Sante Fe Pacific Gold Company staff, we informed them that the expansion would require a Department of the Army Permit.

3D c) The DEIS makes reference to ephemeral washes within the project area. The DEIS does not contain any information regarding the impacts to waters of the United States. This information should include the location of the existing ephemeral streams in the project area, and the routing of stormwater flood flows.

3E d) Chapter 4: Consequences of the Proposed Action and Alternatives - The DEIS does not address the existing and proposed impacts to ephemeral drainages in this section. The DEIS should include the actual boundaries properly delineated on a project site map and the areas previously impacted and proposed to be impacted should be identified.

**RESPONSE 3B**

Table 1-2 has been corrected in the Errata section in Chapter 3 of this FEIS so that the proper page numbers are referenced. Also see Response 3E below.

**RESPONSE 3C**

The U.S. Army Corps of Engineers (USCOE) has reviewed the wetlands delineation report and determined that an individual 404 Permit is not required for the Lone Tree Mine Project (see copy of USCOE letter in Appendix B). The Proposed Action may be constructed under authority of Nationwide Permit Number NW26 that allows for placement of dredged or fill material in waters of the United States in isolated waters or above headwaters.

**RESPONSE 3D**

The DEIS does describe predicted impacts to Waters of the United States on page 4-45 under Direct and Indirect Impacts - Proposed Action (Vegetation). Stormwater routing at the Lone Tree Mine is described on page 2-26 of the DEIS; none of these diversions affect Waters of the U.S. at the project site. There is one primary definable ephemeral channel that extends through the center of the project site in Sections 2, 11, and 14 (T34N R42E); this channel is highlighted in the delineation report (Gibson and Skordal 1993). Also see Response 3E below.

**RESPONSE 3E**

See Response 3D above. The delineation report (Gibson and Skordal 1993) shows existing Waters of the U.S. (WUS) and WUS impacted since 1984. The previously impacted WUS are located in Section 11 (T34N R42E). Waters of the U.S. proposed to be impacted are located in Section 14 (T34N R42E) and consists of a single channel extending north-south through the west half of the section; total disturbance would be approximately 0.4 acre (3 feet wide by 5,800 lineal feet) on federal land (see page 4-45 in the DEIS). A new figure has been prepared that shows the ephemeral WUS channel and previous/proposed impacted areas (see Figure Appendix C-1 in Appendix C).

3F e) Page 4-47: the Deis references the development of a bank stabilization plan for problems that might occur along the Humboldt River. This is an activity that would require a Department of the Army Permit and should be shown and discussed within the EIS.

I have enclosed an excerpt from a previously approved FEIS, as a guide to the format and content. Modification may be necessary for inclusion of your data.

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If you have any questions, please write to Kevin J. Roukey at our Nevada Field Office, C. Clifton Young Federal Building, 300 Booth Street, Room 2103, Reno, Nevada 89509, telephone (702) 784-5304, FAX (702) 784-5306. We appreciate the opportunity to be included in your review process.

Sincerely,

Kevin J. Roukey
Chief, Nevada Office

Enclosure

**RESPONSE 3F**

Santa Fe Pacific Gold would acquire a permit from the U.S. Army Corps of Engineers prior to initiation of any bank stabilization activities.

# Letter #4

STATE OF NEVADA
DEPARTMENT OF MUSEUMS, LIBRARY AND ARTS
STATE HISTORIC PRESERVATION OFFICE
Capitol Complex
100 Stewart Street
Carson City, Nevada 89710

BOB MILLER
*Governor*

JOAN G. KERSCHNER
*Department Director*

RONALD M. JAMES
*State Historic Preservation Officer*

February 13, 1996

Mr. Gerald Moritz
EIS Project Manager
Bureau of Land Management
Winnemucca District Office
705 E. 4th Street
Winnemucca NV 89445

RE: Draft Environmental Impact Statement for Santa Fe Pacific Gold Corporation's Lone Tree Mine Project, Humboldt River Basin at Lone Tree Hill near Buffalo Mountain, Humboldt County.

Nevada State Clearinghouse SAI: #96300099
Comments Due: February 26, 1996

Dear Mr. Moritz:

4A The Nevada State Historic Preservation Office (SHPO) reviewed the draft EIS for the proposed undertaking. The SHPO notes that the BLM identified 97 cultural resources inside the boundaries of the area of potential effect (APE) for the proposed undertaking. Two of these resources, CrNV-22-5544 and CrNV-22-5556, were determined eligible for the National Register of Historic Places under criterion A. This document states that these two properties will not be adversely affected by the proposed undertaking. This document does not appear to address, however, the potential effect that this undertaking might have on the setting of the historic properties. More specifically, will this proposed undertaking introduce visual or audible elements that are out of character with the properties or alter their setting (36CFR 800.9)?

According to our phone conversation with Ms. Peggy McGuckian, the BLM is currently preparing a cultural resources inventory report and/or a summary of the cultural resources inventory reports produced to date. In addition, this document will contain the BLM's determination project effect for this proposed undertaking.

The SHPO will await the BLM's determination of project effect before commenting on this undertaking. Thank you for providing this office with an opportunity to comment on the subject document.

**RESPONSE 4A**

The Area of Potential Effect (APE) for cultural resources at the Lone Tree Mine site has been revised to include only the expansion area shown on Figure 2-8 of the DEIS (page 2-33). The APE includes (T34N R42E): the proposed pit expansion (Sections 12 & 14); haul roads (Sections 12 & 14); overburden disposal areas (Sections 12, 14, 23, & 24); expanded tailings impoundment (Section 23); and leach pads #5 and #6 (Section 15). This expansion area has been subjected to seven cultural resource inventories: Price BLM CR2-2269(p); Soper BLM CR2-2485(p); Johnson BLM CR2-2396(p); Obermeyr/Dugas BLM CR2-2632(p); Johnson BLM CR2-2384(p); Johnson BLM CR2-2376(p); and Johnson BLM CR2-2678(p) (FWJ-139). The Cultural Resources section from Chapters 3 and 4 of the DEIS have been revised and are included in the Errata section in Chapter 3 of this FEIS.

A total of three cultural resource sites would be directly impacted by the Proposed Action; however, none of the sites are eligible for listing on the National Register of Historic Places (NRHP). Because no impacts are expected on cultural resources, no avoidance or mitigation is necessary.

Two NRHP eligible sites within the general mine area that are not part of the APE are located north of Lone Tree Hill (over 1 mile from any of the proposed disturbance). Topography obstructs the view of proposed disturbance from these sites (CrNV-22-5544 and CrNV-22-5556). There will be no visual or audible effects to cause indirect impacts from the Proposed Action to any of these two sites. See the revised Chapter 4 Cultural Resources section in the Errata section in Chapter 3 of this FEIS.

Mr. Gerald Moritz
February 13, 1996
Page 2 of 2

If you have any questions concerning this correspondence, please feel free to call me at (702) 687-5138.

Sincerely,

Rebecca Lynn Palmer
Archaeologist

cc: Ms. Julie Butler, Nevada State Clearinghouse

# Letter #5

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION IX
75 Hawthorne Street
San Francisco, CA 94105-3901

February 16, 1996

Gerald Moritz
Bureau of Land Management
705 E. 4th Street
Winnemucca, NV 89445

Dear Mr. Moritz:

The U.S. Environmental Protection Agency (EPA) has reviewed the Draft Environmental Impact Statement (DEIS) for the **Lone Tree Mine Expansion Project, Humboldt County, Nevada.** Our comments are provided pursuant to the National Environmental Policy Act (NEPA), the Council on Environmental Quality's NEPA Implementation Regulations at 40 CFR Parts 1500-1508, and our authorities under Clean Air Act Section 309.

The DEIS evaluates the impacts of expanding the Lone Tree Mine. The Proposed Action includes expansion of the existing Lone Tree Mine open pit, continuation of mine dewatering and discharge, expansion of the tailings impoundment, and expansion of the overburden disposal facility. The current Plan of Operation involves disturbance of 2,553.5 acres of land through the year 1999. The Proposed Action would disturb an additional 1,023.6 acres (847.6 acres of which are public lands) through 2006. The No Action alternative, which involves continuing existing operations, is also evaluated.

We have rated this DEIS as EO-2 -- Environmental Objections-Insufficient Information (see the enclosed "Summary of Rating Definitions and Follow-Up Action"). Our objections to the proposed project are based on its potential to degrade groundwater, impacts to wildlife, and uncertainties regarding acid generation potential. Furthermore, the DEIS does not provide sufficient information regarding impacts to water quality, water quantity, and habitat in the lower Humboldt River basin and local springs; geochemical characterization; facility design; reclamation; hydrogeologic and geochemical modelling; monitoring; and mitigation. The final environmental impact statement (FEIS) should provide the additional information regarding these topics. Our specific comments which are enclosed.

We appreciate the opportunity to review this DEIS. Please send three copies of the FEIS to this office when it is

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officially filed with our Washington, D.C., office. If you have any questions please call me at (415) 744-1015 or Jeanne Geselbracht at (415) 744-1576.

Sincerely,

Carolyn E Yale (for DW)

Deanna M. Wieman, Director
Office of External Affairs

Enclosures
002133/96-008

cc: Doug Zimmerman, NDEP
Pete Tuttle, FWS
Rory Lamp, NDOW

## SUMMARY OF RATING DEFINITIONS AND FOLLOW-UP ACTION

### Environmental Impact of the Action

LO-Lack of Objections

The EPA review has not identified any potential environmental impacts requiring substantive changes to the proposal. The review may have disclosed opportunities for application of mitigation measures that could be accomplished with no more than minor changes to the proposal.

EC-Environmental Concerns

The EPA review has identified environmental impacts that should be avoided in order to fully protect the environment. Corrective measures may require changes to the preferred alternative or application of mitigation measures that can reduce the environmental impact. EPA would like to work with the lead agency to reduce these impacts.

EO-Environmental Objections

The EPA review has identified significant environmental impacts that must be avoided in order to provide adequate protection for the environment. Corrective measures may require substantial changes to the preferred alternative or consideration of some other project alternative (including the no action alternative or a new alternative). EPA intends to work with the lead agency to reduce these impacts.

EU-Environmentally Unsatisfactory

The EPA review has identified adverse environmental impacts that are of sufficient magnitude that they are unsatisfactory from the standpoint of environmental quality, public health or welfare. EPA intends to work with the lead agency to reduce these impacts. If the potential unsatisfactory impacts are not corrected at the final EIS stage, this proposal will be recommend for referral to the Council on Environmental Quality (CEQ).

### Adequacy of the Impact Statement

Category 1-Adequate

EPA believes the draft EIS adequately sets forth the environmental impact(s) of the preferred alternative and those of the alternatives reasonably available to the project or action. No further analysis or data collection is necessary, but the reviewer may suggest the addition of clarifying language or information.

Category 2-Insufficient Information

The draft EIS does not contain sufficient information for EPA to fully assess environmental impacts that should be avoided in order to fully protect the environment, or the EPA reviewer has identified new reasonably available alternatives that are within the spectrum of alternatives analyzed in the draft EIS, which could reduce the environmental impacts of the action. The identified additional information, data, analyses, or discussion should be included in the final EIS.

Category 3-Inadequate

EPA does not believe that the draft EIS adequately assesses potentially significant environmental impacts of the action, or the EPA reviewer has identified new, reasonably available alternatives that are outside of the spectrum of alternatives analyzed in the draft EIS, which should be analyzed in order to reduce the potentially significant environmental impacts. EPA believes that the identified additional information, data, analyses, or discussions are of such a magnitude that they should have full public review at a draft stage. EPA does not believe that the draft EIS is adequate for the purposes of the NEPA and/or Section 309 review, and thus should be formally revised and made available for public comment in a supplemental or revised draft EIS. On the basis of the potential significant impacts involved, this proposal could be a candidate for referral to the CEQ.

*From: EPA Manual 1640, "Policy and Procedures for the Review of Federal Actions Impacting the Environment."

Lone Tree Mine Expansion DEIS
EPA Comments -- February, 1996

## I. Water Quality

### A. Pit Lake and Groundwater

5A According to the DEIS (p. 4-37), the concentrations of fluoride, nickel, and antimony in the pit lake would exceed drinking water standards after the pit lake reaches a hydraulic steady state. Pit lake water would move as subsurface flow out of the pit area and mix with groundwater as part of the natural groundwater flow system in that area, and groundwater immediately downgradient of the pit would be adversely affected. EPA objects to the proposed project if groundwater would be degraded by subsurface flow of pit water out of the pit. This also appears to conflict with BLM's Nevada Cyanide Management Plan and Nevada Division of Environmental Protection's (NDEP) Regulations Governing Design, Construction, Operation and Closure of Mining Operations (445.24342), which prohibit degradation of groundwater by mining facilities. The FEIS should discuss whether the proposed project would conflict with BLM and NDEP policies and/or regulations and how it would be mitigated to ensure against degradation of groundwater.

**RESPONSE 5A**

The report, *"Revised Prediction of Water Quality in the Lone Tree Mine Pit Lake"* (PTI 1996), evaluates the potential magnitude to which outflow from the Lone Tree Mine pit lake could degrade groundwater. The U.S. Geological Survey solute transport model *PATCHI* was used for the simulations that incorporate advection, dispersion, adsorption, and decay. Results of this modeling show the following (see Appendix D for a summary of the PTI model):

1) The pit lake pH and aluminum levels will likely exceed the upper secondary standards of 8.5 s.u. and 0.2 mg/L, respectively. These conditions result from the decreasing partial pressure of $CO_2$ in the groundwater as it flows into the lake. Chemical modeling indicates that pH and aluminum concentrations will decrease to below the standards when the lake water enters the aquifer and the pressure of $CO_2$ increases again.

2) At 160 years after mining, groundwater antimony, arsenic, and fluoride concentrations resulting from water exiting the Lone Tree pit lake are predicted to be below drinking water standards within 70, 40, and 15 feet of the alluvial/bedrock contact, respectively. This boundary is the edge of the pit in the northern and southern portions of the pit, and the eastern edge of Lone Tree Hill on the eastern side of the pit.

3) Observed "background" concentrations of antimony, arsenic, fluoride, and TDS in groundwater in some wells downgradient of the Lone Tree pit exceed drinking water standards for each of these constituents.

4) During the period of pit lake infilling for the first 160 years, no pit lake water is predicted to move off-site with the regional groundwater system.

As a result of these modeling studies and since no receptors of groundwater occur within the predicted zone of excursion downgradient of the Lone Tree Mine pit lake, BLM does not believe that there would be impairment of beneficial uses of water of the state. Monitoring of groundwater around the mine pit will be required to continue after cessation of mining until NDEP believes that no adverse impacts would occur. NDEP may, however, require future mitigation.

5B The FEIS should further discuss the potential ecological impacts of pit lake water quality, particularly for nickel, fluoride, and antimony (DEIS, p. 4-37). The FEIS should provide the basis for these conclusions.

5C The DEIS (p. 4-38) states that contamination in groundwater would be naturally attenuated downgradient of the pit so that water quality would approach background concentrations. Total dissolved solids (TDS) comprise a minimally reactive groundwater contaminant that would occur at relatively high concentrations downgradient of the pit as a result of out flow from the pit. TDS would degrade water quality and would not substantially be diluted as it moves downgradient. The FEIS should indicate how far from the pit groundwater would return to background conditions for each contaminant in both the alluvial and bedrock aquifers under the proposed action. The FEIS should also discuss the long-term water quality impacts to springs downgradient of the pit, such as Planck and Stonehouse springs, which theoretically will flow again following a return to pre-mining groundwater levels. It appears possible that these springs might not recover if they continue to be affected by the cone of depression after the groundwater reaches hydraulic equilibrium. The FEIS should discuss mitigation measures that would be implemented to restore or replace these springs.

**RESPONSE 5B**

A screening-level risk assessment conducted for the Lone Tree Mine (ENSR 1996) indicates that post-mining water quality of the pit lake would likely be toxic to fish and other aquatic organisms such as insects and mollusks. Toxicity would be due to levels of aluminum, silver, arsenic, boron, mercury, and antimony (nickel and fluoride were predicted not to be toxic). These constituents would exceed State of Nevada acute and chronic standards for aquatic life. The exceedances would occur for some or all of the time following mine closure and when the pit water chemistry reaches a steady state 162 years following closure. As a result of the predicted non-development of aquatic organisms, fish also are likely not to exist in the Lone Tree pit lake.

Although the pit water quality would prevent establishment of aquatic organisms and fish, it would likely not pose a risk to terrestrial organisms that come in contact with it (ENSR 1996). The risk assessment indicates that, although wildlife such as ducks, sandpipers, chukar, mule deer, bats, and bald eagles may come into contact with the pit water, the period of exposure and uptake of toxic compounds would not pose a risk to wildlife that may drink the water or eat food (if any) exposed to the water.

Because no aquatic organisms would likely colonize the pit lake, the potential for bioaccumulation in their tissues and at higher trophic levels of the food chain are not expected. Predators at or near the top of the food chain (e.g., bald and golden eagle, coyote, and bobcat) are not predicted to be exposed to toxic chemicals through ingestion of contaminated prey.

A summary of the ENSR (1996) risk assessment report is contained in Appendix E.

**RESPONSE 5C**

See Response 5A above for information regarding the predicted extent of groundwater impacts downgradient of the Lone Tree pit lake after cessation of mining. No impacts to the water quality of springs are expected to occur from the pit lake.

Mitigation measures for impacted springs are described in Appendix A of this FEIS. Mitigation measures, however, would not be implemented for springs that were dry prior to initiation of mine dewatering (e.g., Stonehouse and Planck springs).

5D The FEIS should discuss why TDS would stabilize in the pit lake at a concentration of approximately 1,380 mg/L (DEIS, p. 4-37).



5E The DEIS (p. 4-41) states that quality of water in the post-mining pit lake and groundwater quality surrounding the mine pit would be evaluated semiannually until steady-state conditions are achieved. However, it appears from the DEIS that significant groundwater degradation might not occur until after steady-state conditions are achieved. Therefore, monitoring could also be necessary for a long time following the achievement of a hydraulic steady-state in the pit. The FEIS should clarify this. In addition, the FEIS should include the complete list of parameters that would be monitored in surface water and groundwater for the proposed project.

**RESPONSE 5D**

The steady-state concentration of TDS is predicted to be approximately 900 mg/L based on model predictions by PTI (1996) (see revised Chapter 4 of Water Resources in the Errata section of this FEIS; also see Appendix D in this FEIS for a summary of the pit lake geochemistry study). This concentration is higher than background TDS levels of about 500 mg/L because of increases in the concentrations of some chemical constituents in the final pit lake due to evaporation of lake water.

**RESPONSE 5E**

As stated on page 4-40 of the DEIS, monitoring and mitigation measures would continue until the BLM and/or NDEP determines that impacts are no longer of concern. Surface water and groundwater quality parameters that would be analyzed during the proposed project are the same parameters as those listed in Tables 3-12 and 3-19, respectively, of the DEIS.

B. Humboldt River Basin

The DEIS (p. 4-77) states that the contribution by mine dewatering to the overall load of contaminants that would reach the lower portions of the Humboldt River, including the Humboldt Sink, is expected to be negligible. The DEIS (pp. 4-36, 4-76) also states, however, that it is difficult to predict contaminant loads from the Lone Tree mine dewatering discharge that would occur in the lower reaches of the Humboldt River, including Rye Patch Reservoir and the Humboldt Sink. Discharges to the Humboldt River are increasing as a result of increased dewatering at several mines in the Humboldt basin. Over the next several decades, flows reaching the lower Humboldt River could increase, resulting in water quality effects in the river itself, Rye Patch Reservoir, and Humboldt Sink. 5F The FEIS should discuss how the increased daily contaminant loads and the flushing of contaminants by increased flows would affect the lower Humboldt River system, specifically impacts to human health, fish, wildlife, and vegetation.

**RESPONSE 5F**

Calculated loads of various constituents (i.e., arsenic, copper, iron, lead, zinc, TDS, and chloride) discharged to the Humboldt River from the Lone Tree Mine are summarized in Table Appendix F-1 of this FEIS (Appendix F). The annual load in the Humboldt River of the same constituents, calculated using water quality data obtained from the Humboldt River before Lone Tree Mine discharged to the river (pre-1992), are summarized in Table Appendix F-2 of this FEIS (Appendix F). Natural loads in the Humboldt River were calculated using an annual mean flow rate of 324 cubic feet per second (cfs).

Comparisons between constituent loads in Lone Tree Mine discharge water to natural loads in the Humboldt River prior to receiving Lone Tree Mine discharge water are presented in Table Appendix F-3 of this FEIS (Appendix F). For the 12-year period of 1995 through 2006 (discharge period for the Lone Tree dewatering program), the ratio of total constituent loads in Lone Tree Mine discharge water to Humboldt River water ranges from approximately 2.6 percent for lead to 48 percent for iron. The load in the Humboldt River for an extended period (e.g., 100 years) compared with 12 years of mine water discharge results in ratios for lead and iron of 0.3 and 6 percent, respectively. Assuming that the natural chemical load in the Humboldt River has been relatively constant for hundreds of years, the total contribution of chemical loading to the Humboldt River (and ultimately the Humboldt Sink) from the Lone Tree Mine discharge is relatively small.

As a result of the discussion above, potential effects on human health, fish, wildlife, and vegetation from mine discharge water loading to the Humboldt River are expected to be minimal. For the relatively short duration of Lone Tree Mine water discharge (12 years), concentration of the discharge water is more important than loading with respect to potential impacts. Concentrations of constituents of the discharge water are not expected to have adverse effects on human health, fish, wildlife, or vegetation.

5G The DEIS states that the proposed action would increase erosion of the Humboldt River channel, the lower portion of Herrin Slough, and the Iron Point Relief Canal (p. 4-32). The DEIS continues on to state that the proposed action is not expected to have a significant effect on stream channel stability because the maximum discharge rate would not change for the proposed action (p. 4-32). These statements appear inconsistent and should be clarified in the FEIS. The cumulative impacts of the proposed action must be considered (i.e., the impacts of discharging 75,000 gallons per minute to the Humboldt River) regardless of whether this discharge is already permitted. The FEIS should indicate how far down the Humboldt River, Iron Point Relief Canal, and Herrin Slough erosion would occur, how significant it would be, where stream stability and ambient levels of total suspended solids would be reached, and how actual channel composition (e.g., cobble embeddedness, particle size) and

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aquatic and riparian habitat could change. In order to confirm that erosion is not significant, we recommend that BLM consider requiring monitoring for turbidity, total suspended solids, and total dissolved solids downstream in Herrin Slough, the canal, and the Humboldt River as a provision in the Plan of Operation.

**C. Waste Rock Characterization and Handling**

5H The acid generating potential of the waste rock is not adequately addressed in the DEIS. The FEIS should provide a more detailed discussion regarding the acid potential of waste rock, tailings, and pit walls, including a more detailed summary of the waste rock characterization procedures and results. For example, what type of kinetic tests were conducted, how long did they run, and how many samples of each rock type were tested? How did results from static and kinetic tests compare? Did kinetic tests positively demonstrate that all material with an acid neutralization potential to acid generation potential (ANP:AGP) of greater than 1.2:1 would be acid neutralizing at this site?

**RESPONSE 5G**

As stated in the DEIS (pages 4-32 and 4-35), mine water discharge to the Humboldt River would cause increased erosion of the river channel; however, the amount of erosion is expected to be relatively low because of the channel capacity and mixture of silt, sand and gravel that compose the river channel. When water enters the Herrin Slough from the Iron Point Relief Canal, it spreads out in a low gradient, braided channel system where the water picks up some sediment prior to entering the Humboldt River. The numerous small channels in the slough are in a natural state of flux, changing course frequently when water moves through them. As a result, when water in the Herrin Slough reaches the Humboldt River, the sediment load is similar to that in the river and erosional effects are minimal. Even the Humboldt River below the confluence with the Herrin Slough has a strong meander pattern with numerous side channels that transport excess water during high flows.

Most erosion to the river channel occurs during a relatively short period during high spring runoff events when the flow rates and volumes are higher. At these times, the mine discharge generally would account for less than 10 percent of the total river flow. During periods of low flow in the Humboldt River, the sediment load in the discharge water travelling through the Iron Point Relief Canal and Herrin Slough would be similar to the natural sediment load in the Humboldt River. It would be very difficult to discern erosion caused by the mine discharge water from erosion caused by natural flows in the river.

Any additional sediment picked up by the discharge water entering the Humboldt River is expected to occur gradually because of the low river gradient. Monitoring for total suspended solids (TSS) in the Herrin Slough just prior to entering the Humboldt River occurs as part of the NPDES permit issued by the State of Nevada (see revised Table 3-20 in the Errata section in Chapter 3 of this FEIS and Response 8FF). Discharge water from the Lone Tree Mine is also monitored for turbidity and total dissolved solids (TDS).

**RESPONSE 5H**

The acid producing potential of mine materials is addressed in the DEIS -- Chapter 4, Geology and Minerals (pages 4-2 and 4-3), and Water Resources (page 4-39). The discussions in Chapter 4 were based upon evaluations referenced in the text. The information in Appendix G of this FEIS is provided to clarify acid producing potential evaluations conducted for the Lone Tree Mine.

5I According to the DEIS (p. 4-3) materials with an ANP:AGP of less than 1.2 would be selectively placed in overburden disposal areas to reduce the potential for acid generation. We strongly recommend that an ANP:AGP ratio of 3:1 be used as the cut-off for potentially acid-generating material unless kinetic testing has verified that none of the material that would be excavated at the Lone Tree mine would be potentially acid generating at an ANP:AGP ratio of more than 1.2.

5J The DEIS mentions surrounding acid generating material with neutralizing material in the waste rock dump (p. 2-19). We recommend that overburden with acid potential be admixed with neutralizing material before being placed into the overburden pile on top of a sufficient thickness of neutralizing material. Should sampling indicate that some tailings would be acid generating, those tailings should also be admixed with and surrounded by neutralizing tailings.

5K The number of samples that would be tested quarterly for acid potential appears extremely low. The FEIS should provide a justification of this frequency. We recommend that the FEIS include the Ore and Waste Material Characterization Program as an appendix.

5L According to the DEIS (p. 2-27), the overburden disposal facilities have the potential to mobilize chloride, arsenic, iron, and manganese under normal weather conditions, but the predicted concentrations of these elements are 10 times less than

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the respective drinking water standards. The FEIS should discuss the characterization data available that indicate this.

**RESPONSE 5I**

As stated in Appendix G of this FEIS, kinetic testing of overburden material indicates that rock with an acid-neutralization potential to acid generation potential (ANP:AGP) ratio of 1.24:1.0 or less is potentially acid generating at the Lone Tree Mine. The Lone Tree Mine will segregate rock material with an ANP:AGP ratio of less than 1.2:1.0 (NDEP requirement) and will encapsulate with non-acid producing rock in the interior of the overburden disposal facility.

**RESPONSE 5J**

Comment noted. Mixing of rock in the overburden facility and within the tailing impoundment is not necessary, based upon results of kinetic testing, commitments for final closure testing, and the proposed reclamation plan.

**RESPONSE 5K**

The number of samples tested quarterly for acid potential is established by NDEP. Typically, 5 to 8 samples are collected each quarter depending upon the types and quantities of materials mined during the quarter. If the sample demonstrates a net acid generation potential (ANP:AGP ratio of 1.2 or less), and if the sample represents more than 10 percent of the total mass of overburden mined for that particular quarter, kinetic testing is conducted. All materials that demonstrate a net acid generation potential are encapsulated by non-acid generating rock.

Over the life of the mine, adequate samples should be available to characterize tailing material. The Acid Mine Drainage Mitigation Plan (WESTEC 1993) for the mine is available from BLM upon request. The placement of baseline studies within an EIS generally is not done because they would make the document very voluminous.

**RESPONSE 5L**

The statement on page 2-27 of the DEIS (1st column, last paragraph) has been modified as shown in the Errata section in Chapter 3 of this FEIS.

5M Table 2-2 in the DEIS provides tailings composite sample results of the meteoric water mobility procedure, with several contaminants exceeding drinking water standards when pH is 9.3 - 9.64. The FEIS should discuss the implications of these results. Furthermore, the FEIS should discuss whether the pH of the tailings would be expected to decrease over time and, if so, what the predicted concentrations of contaminants in the leachate would be.

II. Water Quantity

5N The FEIS should provide the baseline conditions and assumption parameters that were used in the groundwater flow modeling.

5O The ten-foot drawdown contour displayed on Figure 3-11 and discussed on page 3-45 and 4-29 of the DEIS represents too large a drawdown to be considered a boundary beyond which no significant effect would occur. A ten-foot drawdown at a spring (even considering seasonal changes) could destroy it. Furthermore, faulting in the area could affect springs in unpredicted ways. The fact that Hot Pot Springs is outside the ten-foot contour but has already been affected at least in part by pumping appears to demonstrate that the ten-foot drawdown contour is not an appropriate delineation beyond which significant impacts would not occur. In addition to the ten-foot contour, we recommend that a three-foot contour be plotted and any additional potential impacts to springs be discussed in the FEIS.

5P The wells described on Table 3-19 cannot be found on any map provided in the DEIS, and Table 3-21 has inadequate well location descriptions. The wells do not correspond with Figure 3-13. It is, therefore, not possible to draw relational conclusions between mine activities and well parameters. The FEIS should provide a map or a correlation.

III. Facility Design

5Q The FEIS should describe in more detail the design of the tailings impoundment liner. The FEIS should specify the source of clay for the clay liner, as well as its permeability and thickness, and describe the overlying protective layer. In addition, the FEIS should similarly describe the compacted clay pads beneath the ore stockpiles.

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**RESPONSE 5M**

Table 2-2 has been revised and is included and discussed in the Errata section in Chapter 3 of this FEIS. In addition to the results not exceeding 10 times the respective maximum contaminant level (MCL), the lined tailings impoundment will be reclaimed to minimize water percolation from direct precipitation and prevent surface water runoff from coming into contact with the impoundment; therefore, there should be insufficient water to create leachate after closure.

**RESPONSE 5N**

A summary of the groundwater flow model conducted by HCI (1994a, 1995b, 1996a, 1996b) for the Lone Tree Mine Project is in Appendix H of this FEIS.

**RESPONSE 5O**

As stated on page 4-11 of the DEIS (2nd column, 2nd paragraph), some groundwater drawdown would occur outside of the maximum extent of the 10-foot contour line; however, water level changes in these areas would be difficult to distinguish from seasonal or long-term variations in natural conditions. The DEIS does address potential impacts outside of the predicted 10-foot contour line; for example, four springs beyond this line are included in the analysis of potential impacts to account for groundwater effects that may extend outside of the 10-foot drawdown contour (e.g., Hot Pot Springs).

**RESPONSE 5P**

From Table 3-19, wells M/O 11-2, OW-9A, and M/O 35-19-1B are shown on Figure 3-13; however, the M/O-prefix has been removed to allow more room on the figure for labels. Wells WW-2, WW-4, WW-5, WW-10, and WW-12 are mine dewatering wells located immediately around the mine pit. The majority of wells listed in Table 3-21 are shown on Figure 3-13. The wells that were omitted from the figure in the DEIS have been added to revised Figure 3-13 in this FEIS (see Errata section in Chapter 3).

**RESPONSE 5Q**

The tailings impoundment liner system is described on page 2-21 of the DEIS. The source for the clay liner is the Clay Borrow Area shown on Figure 2-4. The clay material used in construction of the tailings impoundment liner system and compacted clay pads for ore stockpiles has been tested and meets NDEP requirements under permit NEV90058.

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5R It is unclear from the DEIS how the heap leach pad liner in the Phase 5 and 6 heap leach facilities would be protected from puncture by the run-of-mill ore. The FEIS should clarify the design of the Phase 5 and 6 heap leach pads. If gravel is to be used, the FEIS should specify maximum particle size.

5S The FEIS should discuss how the change in the interior tailings dam embankment slope from 3H:1V to 2H:1V affects the factor of safety of the structure (DEIS, p. 2-38).

5T The FEIS should indicate where the stormwater runoff from the facility and tailings impoundment would go during the 25-year storm and storms exceeding the 25-year event.

5U The DEIS indicates that SFPG would cease discharging mine water for as long as necessary if the State Engineer makes a finding that cessation of discharge is necessary to prevent exacerbation of flooding conditions in the Humboldt River. The FEIS should describe how this would be accomplished (e.g., where would pit water temporarily be held?).

## RESPONSE 5R

Leach pad construction for Phase 5 and 6 would be as described on page 2-19 of the DEIS. The leach pad would be protected from puncture by the run-of-mine ore by covering the synthetic liner with fill material to protect the liner. This fill material would consist of oxide waste material crushed to meet design gradational specifications (100% passing 3/4-inch). The liner cover fill is placed (non-compacted) in a 2-foot thick layer over the entire leach pad area. The final design will meet NDEP requirements.

## RESPONSE 5S

To increase the tailing impoundment capacity under the Proposed Action, the height of the tailing embankment would be raised and the interior tailing dam embankment slope would be 2H:1V. Stage 1 was constructed with 3H:1V slopes; whereas, stage 2 construction incorporated 2H:1V slopes. The factor of safety for 2H:1V slopes vs. 3H:1V slopes is shown in Table Appendix I-1 provided in Appendix I of this FEIS.

## RESPONSE 5T

Stormwater routing at the Lone Tree Mine is described on page 2-39 of the DEIS under the section "Surface Water Control Facilities". The last sentence on page 2-26 under the section "Surface Water Control Facilities" of the DEIS has been deleted because there are no sediment ponds to collect stormwater runoff in Sections 1 and 11 (see Errata section in Chapter 3 in this FEIS). No stormwater runoff should occur even if the 25-year event is exceeded because of the extra capacity of the facilities and the emergency response plan (SFPG 1993a) that would be implemented to contain the fluids. Stormwater that exceeds the capacity of the mine facilities would be pumped via the existing pipeline system to the tailings impoundment facility (TIF).

## RESPONSE 5U

If SFPG is required by the Nevada State Engineer to cease discharge of water to the Humboldt River because of flooding conditions, the mine dewatering wells would cease pumping and the pit would eventually begin to fill with groundwater. This potentially could result in mining delays until pumping once again lowers the water table to a safe level below and surrounding the mine pit.

IV. Biological Resources

5V The FEIS should provide further detail on revegetation efforts that would be included in the reclamation plan. It should describe the vegetation monitoring plan, success criteria, and contingency plan should the original revegetation efforts fail.

The DEIS (p. 4-48) indicates that the project would result in an irretrievable loss of hydrophytic vegetation at five springs until the hydrologic regime recovers sufficiently to support similar size stands of wetland vegetation. The DEIS (p. 4-49) then states, however, that loss of water sources for wildlife and habitat associated with springs that are dewatered by mining would be mitigated by providing water to affected springs by pipeline, by drilling wells and pumping water, or by other appropriate methods. 5W The FEIS should clarify whether these mitigation measures would be sufficient to recreate the pre-mining conditions of the springs, while at the same time not degrading other water sources. We recommend that mitigation measures be selected which would not only provide water for wildlife but recreate pre-mining vegetation conditions as well.

According to the DEIS (p. 4-49), bird and bat mortalities from exposure to cyanide occur at the existing Lone Tree heap leach operation and would continue under the proposed expanded operation. 5X The FEIS should discuss the specific measures that would be implemented to minimize bird and bat exposure to cyanide at the mine. A comparison of potential impacts to wildlife from

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heap leach drip irrigation versus sprinkling should be provided. If ponding on the heap leach surface is the source of cyanide exposure, measures to eliminate ponding should be used, such as applying a layer of larger rock on top of the ore before drip lines are laid out.

**RESPONSE 5V**

The DEIS describes revegetation monitoring and success standards on page 2-51. Additional details on revegetation procedures would be available after initial results of test plots are analyzed. The BLM and NDEP provide guidance and regulatory programs regarding revegetation, monitoring, success criteria and remediation. SFPG is obligated to satisfy these requirements and prepare plans acceptable to the agencies.

**RESPONSE 5W**

Mitigation of springs that dry up as a result of the proposed project is described in Appendix A in this FEIS. Mitigation emphasis would be placed on providing water in a tank or other artificial structure. Water would be replaced for livestock utilization and some species of wildlife may also drink from replacement sources. No attempt would be made to recreate the pre-mining vegetation at springs that dry up.

**RESPONSE 5X**

The Lone Tree Mine has netted the pregnant and barren ponds that have a higher level of cyanide; the tailings impoundment cyanide is destructed with the addition of Caro's acid. At the leach pads, an operator inspects the top of the pads daily and makes site-specific notes of potential problem areas on a daily report. Any mitigation measures taken during the shift are also noted on this report. Accumulations of solution are minimized through management of the solution application which is guided by the ore material composition and by manipulation of the surface of the leach pile (e.g., grading and ripping). Several types of tube emitter lines with differing distance standards between each emitter may be installed or wobbler-type sprinklers used where they can be effective. Variable rates of solution application also aid in surface control of ponding.

5Y The DEIS indicates that both native and non-native plants would be used to reclaim disturbed areas. EPA urges BLM to revegetate disturbed areas with appropriate native plants in an effort to reestablish the biological diversity of the original vegetative communities on the project site.

5Z The FEIS should discuss in detail any potential impacts of a steady discharge of up to 75,000 gallons per minute to aquatic and riparian communities in the Humboldt River that may rely on seasonal cyclicity for viability.

**RESPONSE 5Y**

Final mitigation measures would include a revegetation plant mix which would result in the reestablishment of vegetative cover (see Appendix A in this FEIS for mitigation measures). The plant mix would be comprised of native and introduced species in order to achieve this goal. The Reclamation section of the DEIS on page 2-40 (2nd column, last paragraph) lists the reclamation and revegetation goals, including achieving as close to 100 percent of the perennial plant cover of selected vegetation communities or reference areas as possible.

**RESPONSE 5Z**

See Responses 8XX and 8YY to the U.S. Fish and Wildlife Service (USFWS) letter in this FEIS for information regarding potential impacts to riparian communities. See Responses 8CCC, 8GGG, and 8JJJ to the USFWS letter in this FEIS for information about potential impacts to aquatics in the Humboldt River from the Lone Tree Mine discharge.

## Letter #6

**IL SHEEP**
DIVISION OF AGRI BEEF CO.

February 15,1996

TO: Gerald Moritz, EIS Project Manager, Bureau of Land Management, Winnemucca District Office, 705 E. 4th Street, Winnemucca, Nevada 89445.

PURPOSE: Comments on EIS Lone Tree Mine Expansion Project.

FROM: Tom Filbin, Mgr. IL Sheep Ranch (Agri Beef Co.)

COMMENTS: The proposed increase of mine dewatering by the Lone Tree Mine Expansion Project appears to me to have very serious conflict potential for the livestock operations of Agri Beef Co's sheep allotments.

Mine dewatering has already, after only a short duration of existence negatively impacted the I L sheep (Agri Beef Co.'s) operation. Even though mitigating action was taken, the results are not as good as before the mine dewatering commenced.

The enormity of the proposed dewatering increase, combined with the existing effects already happening, raises huge questions of how harmful to us will it really be? I have recently become aware that this increased mine dewatering could decrease and possibly stop the flow of springs and other area water sources for a radius of 25 to 30 miles from the point of pumpimg.

After meeting on February 1st with Ken Pavlich, Lone Tree

6A Mine manager, for clearification and information on this proposal I seriously question how the expansion can be made without major, negative impacts to all parties that are in the potential conflict area of a 25 to 30 mile radius.

What assurance will be made in the event of another negative dewatering result like the one at Brooks Hot Spring?

P.O. Box 127
Golconda, Nevada 89414 Telephone 702 738-3218

**RESPONSE 6A**

As stated in the DEIS on page 4-26, predicted impacts to springs may extend a distance of 5 to 7.5 miles from the Lone Tree Mine. Three springs within this area have ceased flowing within the last 5 years (Brooks, Treaty Hill, and Hot Pot Springs); two springs (Planck and Stonehouse) were dry in 1990 and prior to initiation of mine dewatering. Impacts to the groundwater table and springs are not expected to occur at a radius of 25 to 30 miles.

Mitigation of springs that would be adversely affected by the proposed project is described in Appendix A in this FEIS.

## Letter #7

**SIERRA CLUB**

Toiyabe Chapter — Nevada and Eastern California
P.O. Box 8096, Reno, Nevada 89507

February 15, 1996

Bureau of Land Management
Attn: Gerald Morits, EIS Project Manager
Winnemucca District Office
705 E. 4th St.
Winnemucca, NV 89445

RE: LONE TREE EXPANSION DRAFT ENVIRONMENTAL IMPACT STATEMENT

Dear Mr. Morits:

The following comments are submitted on behalf of the Toiyabe Chapter of the Sierra Club. This group has substantial concerns regarding the adequacy of the Lone Tree Expansion Draft Environmental Impact Statement and, we offer the following comments which have been developed by a group of individuals.

I. Compliance with the National Environmental Policy Act

The Draft Environmental Impact Statement (DEIS) for the Lone Tree project of Santa Fe does not meet the intent or requirements of the National Environmental Policy Act (NEPA).

1. The EIS does not consider in detail any alternatives, as required in NEPA. Section 102(2) (E) of NEPA requires federal agencies to

> "study, develop and describe appropriate alternatives to recommended courses of action in any proposal which involved unresolved conflicts concerning alternative uses of available resources." 42 U.S.C. 4332 (2) (E).

7A The CEQ regulations (40 CFR 1502.14) refer to this requirement as the "heart of the environmental impact statement" and demand that agencies "rigorously explore and objectively evaluate all reasonable alternatives" and "devote substantial treatment to each alternative considered, . . so that reviewers may evaluate their comparative merits." This

EIS considers only the proposed action in detail, and includes the strawman "no action" alternative. Several alternatives were mentioned, but discarded after a brief discussion.

### RESPONSE 7A

Santa Fe Pacific Gold Corporation's Plan of Operations (POO) for the Lone Tree Mine Expansion was developed in close coordination with the Winnemucca District Office of the BLM. This coordinated development of the POO follows procedures and guidelines outlined in CEQ regulations: 40 CFR 1501.2. These regulations provide for early consultation with applicants such that environmental degradation can be limited during the project design phase.

The result of coordination activities associated with development of the Lone Tree Mine Expansion POO is that alternatives to the Proposed Action would not result in substantive mitigation of potential impacts which may result from implementation of the Proposed Action. In addition, BLM determined that none of the range of alternatives identified have any measurable environmental advantage over the Proposed Action. There are no alternative locations for mine facilities or alternative mining methods that were identified that would reduce environmental impacts.

The Proposed Action includes expansion of the Lone Tree Mine pit, expansion of existing overburden disposal facilities, construction of a new overburden waste disposal facility, expansion to an existing tailings disposal facility, expansion to an existing heap leach facility, and extension to the period of mine pit dewatering. With the exception of the proposed new overburden disposal facility, no reasonable alternatives for location of these facilities exist. Areas adjacent to the Lone Tree Mine site are similar in soil, vegetation, wildlife, and water resources to the Lone Tree Mine site. Therefore, alternative locations for the proposed overburden disposal facility and/or existing mine facilities do exist; however, changing the location of these facilities provides no advantage over the Proposed Action.

During early stages of the EIS process, the following were identified as significant issues: increasing mine dewatering rate; elevated temperature of discharge water; and quality of discharge water entering the Humboldt River. However, SFPG installed facilities (e.g., cooling pond system and water treatment plant) to resolve these problems. SFPG also determined that the increased dewatering rate for the Proposed Action would be the same as the maximum rate required for authorized mining on private land.

The only potential alternatives relate to (a) what can be done with excess mine water while the pit is being dewatered, and (b) whether the pit should be backfilled after mining operations cease. These activities could also be considered mitigation measures because they deal with minimizing impacts from the mining project (see 40 CFR 1508.20 for definition of mitigation). See Responses 7B and 7C below for further explanation of why these "alternatives" were not considered viable in the DEIS.

This project will have a substantial impact on the surrounding groundwater system. Alternatives to the proposed project include a mixture of reinjection wells and surface infiltration systems, substitution of agricultural water in the area, or purchase and retirement of other water rights to compensate for the loss of the water from the pit.

7B

Several options for substitution of water were suggested, but dismissed immediately. We were very surprised to see the dismissal of the option of reinjection of water into Pumpernickel Valley in the bedrock material 3 to 5 miles away. The argument for dismissal of this option was that dewatering rates would be increased. This is a cost the mine can well bear, and would allow much more rapid recovery of the groundwater system. A portion of the water can clearly be reinjected into this system and reduce the overall impacts significantly.

Second, excess water can be exported to North Valmy Station and used at a rate of 3000 gallons/minute. We were surprised that the DEIS suggested that this would not be significant by stating that 3000 gallons per minute is a "a relatively small percent of the total dewatering quantity from Lone Tree", and thus comparing 3000 gal/min to the highest dewatering rate (75,000 gal/mine). In fact, 3000 gal/min is a large amount of water by any measure and would decrease the impacts of the mine, particularly if considered with other reinjection scenarios.

Reinjection of the entire quantity of water at the highest flow rate may indeed not be a reasonable option, but reinjection of a large percentage of water or substitution use is entirely reasonable. To not consider an array of reinjection/alternative use options seriously is inconsistent with NEPA.

**RESPONSE 7B**

As stated in the DEIS (page 2-52), SFPG is continuing to evaluate the feasibility of ways to reduce the amount of water discharged to the Humboldt River. As part of a dewatering permit approved November 29, 1995, the Nevada State Engineer required SFPG to submit a report by April 30, 1996 concerning possible disposal alternatives. A copy of this SFPG (1996) report is included as Appendix J in this FEIS. Also included in Appendix J are two reports by HCI (1993a and 1993b) that evaluate the feasibility of injection and infiltration.

The SFPG (1996) report explains that three water substitution options may be implemented for the Lone Tree Mine dewatering system: (1) 1,100 gallons per minute (gpm) piped to SFPG's Trenton Canyon Mine project 13 miles southeast; (2) 950 gpm piped to the nearby Marigold Mine 4 miles southeast; and (3) 3,000 gpm piped to the North Valmy Station power plant 3 miles northeast. The latter two options still require final approval of third parties and the State Engineer. Correspondence with the State Engineer for these options is included in Appendix J.

With respect to infiltration and reinjection, SFPG is continuing to evaluate the feasibility of these options. A 19-hole exploration program is currently underway to assess infiltration possibilities, and data from monitoring wells are being evaluated for reinjection capability. If the data from these programs are favorable, SFPG will propose pilot projects to further assess the feasibility of these options.

7C Refilling the pit was not given serious attention. That alternative, although admittedly costly, is credible. Refilling a portion of the original pit is also a potential alternative. Refilling to the water line would reduce the water deficit created by the pit by over 100,000 acre-feet (nearly half of the yearly flow of the Humboldt River) and should have been considered. One option of particular note is mining the Lone Tree expansion, after the majority of the original Lone Tree pit was excavated. Rock from the expansion would then be used to fill in the original mine and decrease the overall impacts. Because of potential groundwater problems from poor pit lake water quality, this alternative may ultimately be required. The "loss of mineral resources" argument is effectively without merit. Once the pit fills with water, that water will almost certainly not meet discharge standards and will require treatment prior to discharge to remove salts and other contaminants. The costs of that treatment may well exceed the costs of remining rock placed back into the pit and, thus, it is conceivably a greater "loss of mineral resources" to allow the pit to refill. It might be worthwhile to discuss the cost of water treatment with ARCO on their problems with treating water from the Berkeley Pit lake.

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7D Because no analysis of alternatives was conducted, the BLM is left with no decision to make. This document violates NEPA and should be rewritten from the beginning. This mine is likely to create the single largest mining-related water deficit in the Humboldt River system of any mine yet proposed in Nevada, and a range of water saving alternatives to the proposed action are required. They are reasonable and although some may introduce additional costs, the BLM has the responsibility and authority to protect other public values. Those alternatives, or a combination of alternatives, can be used to substantially reduce the impacts of this mine, but were dismissed with only a very brief discussion.

**RESPONSE 7C**

Under the No Action alternative, SFPG would complete development of the existing two mine pits located on private land. If SFPG receives authorization to expand mining operations to public land, the configuration of mine pit development on both private land and public land would change. Development of the mine pit on public land would proceed in conjunction with continued mining on private land. The mine pit configuration would change to a single open pit; effectively connecting the current pits into one pit.

Backfilling of the single open pit would, therefore, involve complete rehandling of overburden generated during the mining operation. BLM has determined that rehandling of overburden to backfill the single open pit would not have an advantage over the Proposed Action (see Alternatives Considered But Eliminated From Detailed Analysis; page 2-52; DEIS). SFPG estimates that the cost of rehandling overburden to backfill the pit is $.50 per ton, assuming the pit could be randomly backfilled and no selective handling for water quality protection would be necessary. Therefore, the cost to backfill the pit would exceed $275 million for about 555 million tons of overburden (page 2-32 of DEIS).

Backfilling the Lone Tree pit would also require 10 to 14 years to complete after cessation of mining. During the first few years of backfilling, dewatering would have to continue to allow access for equipment. Rehandling the overburden would also result in additional fugitive dust emissions and emissions from vehicles and equipment. Finally, backfilling the pit would effectively prevent the gold resource remaining around the proposed pit from being mined in the future. Advantages of backfilling the mine pit would include elimination of: the long-term evaporative loss from the pit lake surface, evapo-concentration processes, and the direct exposure of animals and humans to pit lake water.

**RESPONSE 7D**

See Response 7A above. Authorizations pertaining to pumping and discharge of water (including quantity and quality) from the Lone Tree Mine are under the jurisdiction of the State of Nevada. The water resources component of the Proposed Action under review by BLM concerns issues associated with extending the duration of pumping and discharge at Lone Tree Mine.

7E

2. The following statement is a general concern made with all due respect to the Bureau, and also the consultants who prepared the DEIS, but it is a concern that that pervades the document, in our opinion. The overall analysis has the tone of an apologetic for the mining proponent, rather than as an analysis of the impacts. An example of this is the statement referenced above on page 2-53 which attempts to minimize the volume of 3000 gallons per minute as only 5% of the highest pumping rate of 75,000 gallons per minute. A second example is on page S-3 which suggests that "Should water quality change during the dewatering program, SFPG would use chemical precipitation methods to treat the water to Nevada standards". Pray tell, what are those methods. With the possible exception of arsenic precipitation using iron (already indicated in the DEIS), we are aware of no realistic methods which can remove many of the contaminants, particularly boron, sulfate or salts. If those methods exist, they should be listed and a clear plan of implementation included. If they do not exist, a plan for limiting dewatering should be present so that the water regulations are followed. This company has violated the discharge for both arsenic and temperature during the past year, and the Bureau should expect that if violations occur again, they will be asking for a variance, a change in the water quality standards, or some other option similar to what has happened over the previous year. A third example is found on page 2-54 which seeks to minimize the impact of a perpetual 972 acre-foot loss of water by comparing it to the evapotranspiration loss of water from a 750 square mile area of the Humboldt River basin in the Lone Tree area. We find these comparisons to be a thinly veiled attempt to compare apples and oranges and somehow seek to rationalize the large impacts from this mine. The Bureau is in charge of the decision and you have broad authority to protect competing resources.

The preliminary studies, on which much of the DEIS is based, were probably conducted prior to the BLM decision to produce an EIS for the mine, and were almost certainly directed and paid for by the mine proponent. This method of developing the most critical data for the major impact of the mine is fraught with a conflict of interest, since the consultants' continuing financial success is based on the acceptance of the report by the mine proponent. We recognize that consultants are critically important to the production of an analysis of this type; however, the tone of the document regarding the critical issues of water quality and water quantity does not give the reviewer any confidence that a critical analysis was performed by an unbiased writer. Assuming consultants are necessary for preparation of the DEIS, a second set of consultants

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completely removed from mining should be asked to review the scientific assumptions used in these models.

**RESPONSE 7E**

The statement made on page 2-53 of the DEIS regarding diversion of 3,000 gpm to the North Valmy Station is as follows: "A portion of the dewatering water could be diverted for use at the nearby North Valmy Station power plant and Marigold Mine. However, this would account for a relatively small percentage (approximately 5 percent) of the total dewatering quantity from Lone Tree Mine (maximum 75,000 gpm)."

The word "only" was not used in describing the volume of water which could be used by the North Valmy Station and Marigold Mine. BLM does consider 5 percent to be a "relatively small percentage" in the context of the volume of water involved in the dewatering system at the Lone Tree Mine.

As described on page 2-22 of the DEIS, SFPG has constructed a water treatment plant to use chemical precipitation methods to treat arsenic from the discharge water.

Because discharge water associated with the Lone Tree Mine has previously exceeded temperature standards in the Humboldt River, SFPG constructed a cooling pond system to reduce discharge water temperature to meet standards. Based on extensive water quality data collected at the Lone Tree Mine, with the exception of iron, the discharge water has not caused a violation of water quality standards or NPDES permit limits during the last year. SFPG will modify the treatment system for other metals if exceedances of NPDES permit limits occur.

As described on page 2-54, column 1, paragraph 1 of the DEIS, BLM's intention was to provide the reader an understanding of how much 927 acre feet per year evaporative loss of water from the pit-lake surface represents. Natural evaporative losses within the Humboldt River basin near the Lone Tree Mine in contrast to the predicted losses from the pit-lake provides the reader a context by which to evaluate the evaporative loss from the pit-lake. BLM is not attempting to rationalize the large impacts of the Lone Tree Mine; BLM is attempting to provide the reader an understanding of the potential impacts by using comparisons that the reader can understand.

Third-party consultants contracted to prepare the DEIS are responsive to BLM in establishing the scope and depth of analysis in the DEIS. BLM believes that existing procedures for preparation of the DEIS and the analysis contained in the document is objective and represents independent, third-party evaluation of potential impacts.

7F 3. The BLM has not performed a cumulative impact analysis of this action and past, present and likely future actions, as required by NEPA. Two major deficiencies exist in this regard. This mine is within the Humboldt River Basin, and has an impact on the total water budget of the Humboldt Basin. The impacts of this mine on the Humboldt River need to be assessed in relation to other mines in the Basin. Until this analysis has been completed, or at least funded and initiated, no mine expansions which affect significant amounts of water in the Humboldt River should be permitted.

7G The Sierra Club has argued for an *independent* major cumulative impacts analysis of mine dewatering along the Humboldt River for several years, yet none has been initiated, much less completed. Such a study will cost at least five million dollars over five years. Other companies have agreed to contribute to such a study. Since this mine will potentially create the single greatest deficit in the Humboldt River, this mine can not be permitted until those funds are clearly in place. Because of the large impacts from the Lone Tree operation, this company should be responsible for funding a majority of that study. While NEPA does not require that all of the impacts be known prior to permitting a project, it does require that further study be conducted on those issues which remain unresolved.

**RESPONSE 7F**

The cumulative effects analysis included in the DEIS (pages 4-75 to 4-77) provides an analysis for the geographical area for which adequate water resource information exists. For purposes of evaluating cumulative impacts in the Humboldt River basin, the DEIS includes an area that extends from Carlin (more than 100 river miles upstream from the Lone Tree Mine) down to Rye Patch Reservoir (more than 100 river miles downstream from the Lone Tree Mine) and eventually to the Humboldt Sink. It also considered the effects of 17 existing and reasonably foreseeable mines in the cumulative impact assessment area (see DEIS, pages 4-75 to 4-77, and Figure 4-12 and Table 4-7).

A cumulative impact is the "incremental" impact of the proposed action when added to other past, present and reasonably foreseeable actions (defined by CEQ; 40 CFR 1508.7). The DEIS concluded that the incremental impact of the Lone Tree Mine on the Humboldt River basin is to increase flows by up to 167 cfs during mining/dewatering, and to decrease river flows by up to 0.45 cfs while the pit lake fills. To a large extent, these impacts will occur even under the No Action alternative because of Lone Tree Mine operations on private land. The main difference is that dewatering would be extended an additional 7 years and it would take longer for the pit to fill with water after cessation of mining.

Insufficient information is available to describe the total water budget for the entire Humboldt River basin as it pertains to water withdrawals and discharges. Analysis of water resources in this geographic area (the Humboldt River basin) without adequate data would result in very speculative and unwieldy results which would be of limited value (BLM-Guidelines for Assessing and Documenting Cumulative Impacts; WO-IB-94-310).

For other mines located upstream of the Lone Tree Mine (e.g., Newmont Gold Quarry and Barrick Betze mines), effects on the Humboldt River system are or will be described in EISs for those projects. Beyond the information contained in those EISs, it would be essentially impossible to quantify the impacts or make any meaningful conclusions about all mines in the Humboldt River basin on a complex stretch of river more than 100 miles upstream of the Lone Tree Mine. As stated in the DEIS (page 4-76), effects on the Humboldt River would depend on the sequence and magnitude of dewatering and discharge from the various mines.

Under 40 CFR 1502.22, certain procedures must be followed where the agency is evaluating reasonably foreseeable significant adverse effects on the human environment and there is incomplete or unavailable information. The agency need not obtain complete or unavailable

11. **Impacts of the Humboldt Ecosystem due to changes in water level**

Because this mine has such a large impact on the water table in the area, there needs to be a substantially expanded analysis of the ecosystem impacts of reduced stream flow over the decades-long recovery period. We suggest that the impacts on the Humboldt River system will be substantial during that recovery, primarily due to decreased water flow and longer periods of complete loss of flow as the system recovers following dewatering by the mines. How will that loss of groundwater affect riparian vegetation? How will it affect wildlife that depend on that vegetation? How will agriculture be affected when water available for irrigation is reduced by 10-20%?

7H

**RESPONSE 7F** (continued)

information unless (a) the information is "essential" to a reasoned choice among alternatives, and (b) the overall costs of obtaining the information are not exorbitant. More precise information on effects of the Carlin Trend mines to the Humboldt River below the Lone Tree Mine is not essential to a reasoned choice among alternatives for Lone Tree. A study of the Humboldt River basin has been initiated by the U.S. Geological Survey; however, this study will likely take over 5 years and several million dollars to complete. The BLM has determined that the information available on cumulative effects contained in the DEIS and this FEIS is sufficient to make a rational and informed decision regarding the Lone Tree Mine expansion.

**RESPONSE 7G**

Based on BLM's review of the cumulative effects discussion contained in the DEIS, no issues remain unresolved as they pertain to the federal authorization.

**RESPONSE 7H**

As stated in the DEIS (page 4-32), the predicted decrease in Humboldt River flow after cessation of dewatering would reach a maximum of about 200 gpm (0.45 cfs). The average October baseflow for the Humboldt River in this area is 28 cfs; therefore, a decline of 0.45 cfs consists of about 1.6 percent of the baseflow. This flow loss may result in longer periods of dry or very low flow reaches of the river; however, the overall effect on irrigation is expected to be minor. Riparian vegetation would become stressed and die if river flows decrease substantially, particularly during the summer when river flows typically are very low. If riparian vegetation dies, wildlife dependent on willows and other species adapted to high water tables would also be gradually displaced due to reductions in breeding, feeding, and security habitat.

7I Although the water quantity study using the proprietary model suggests a only small impact despite a deficit in excess of 1.1 million acre-feet, we note that American Barrick's Betze dewatering model was off by a factor of five and now is involved in a lawsuit as a result of that error. We suggest that a similar future is likely for this mine.

The macroinvertebrate study on page 3-82 should have been included in the DEIS. The Humboldt County entomologist has produced data on macroinvertebrates for several years. His studies have shown that a substantial impact on these species has occurred over the past several years, although he does not provide a suggestion as to the source of the impacts. However, he did note that populations upstream from the mine and in tributaries were strong. Only in the Humboldt River at Comus and below were the populations

7J seriously affected. The BLM needs to require that studies on macroinvertebrates be conducted above and below the mine, particularly during the times of high stress in the late summer, fall and winter.

**RESPONSE 7I**

The groundwater flow model and DEIS do not suggest a small impact with respect to groundwater loss of 1.1 million acre-feet. Impacts to springs and the Humboldt River as a result of the Proposed Action would include increasing the length of time for groundwater recovery. As stated in the DEIS (page 4-11), groundwater models are a tool that are performed and calibrated using hydrogeologic data from the project site. The application of this model to the Lone Tree Mine is considered to be an accurate representation of actual site conditions; however, groundwater flow in fractured bedrock is not homogeneous and isotropic. As a result, the model will be rerun periodically to adjust to changing conditions in the natural system. See Appendix H in this FEIS for an expanded summary of the groundwater flow model.

The model used for the Lone Tree Mine is not the same model used for American Barrick's Betze Mine, nor are the hydrologists who performed the model the same. The modeling method used for the Lone Tree Mine also was used at the Newmont Gold Quarry Mine, the Echo Bay McCoy/Cove Mine, and the SFPG Twin Creeks Mine. Accuracy of models is dependent on input parameters, the conceptual model, and computer code. For the mines listed above for which the Lone Tree Mine model has been used (including the Lone Tree Mine), several years of dewatering show that actual groundwater drawdown and trends are fairly close to those predicted by the model.

**RESPONSE 7J**

Aquatic monitoring studies were conducted during 1995 at nine sampling stations located upstream and downstream of the site where Lone Tree Mine dewatering discharge enters the Humboldt River. Details of these studies are presented in Appendix K in this FEIS. The monitoring studies did not find that discharge from the Lone Tree Mine had a detectable effect on black flies and other macroinvertebrates.

7K The amount of water discharged by the Lone Tree Mine is likely to far exceed the needs of the agricultural community in Lovelock. Most of the water will then be simply discharged into the Humboldt Sink and evaporate. The DEIS completely ignores the problems associated with evapococentration of contaminants which will be released and accumulate in the Humboldt Sink. The concentrated water in the wetlands associated with the Sleeper Mine contains several constituents that now violate wildlife protection standards. It is very likely that this will also occur in the Humboldt Sink. What species, including endangered and threatened species, are likely to be exposed to these contaminants, and what will be the effect of these substances on the ability of these organisms to thrive. The total biomass will probably increase, but various migratory birds may well experience contaminant concentrations which can potentially be adverse to these avian species. It is indeed probable that this will occur. NAC 445.24352 requires that

"3. Bodies of water which are a result of mine pits penetrating the water table must not create an impoundment which

(a) has the potential to degrade the ground waters of the state; or
(b) has the potential to affect adversely the health of human, terrestrial or avian life.

Basically, we believe that this protection standard cannot be met either with the pit lake water quality or the evapoconcentrated water in the Humboldt Sink. In both cases, the clear potential exists for adverse affects to avian species and the dewatering operation should not be permitted.

The total load of various contaminants which will be discharged into the Humboldt River, and thus predominantly into the Humboldt Sink is not addressed. How much boron, chromium, arsenic, fluoride, selenium will be discharged into the Humboldt Sink?

IV. **Heap Leach and Tailings Closure**

The most significant problem which has become apparent in recent years regarding heap leach decommissioning is the potential for release of contaminants other than WAD cyanide. These include arsenic, selenium, fluoride, sulfate, mercury and other heavy metals. No discussion was made of any of these substances. Although cyanide can be oxidized efficiently, these other elements are not easily removed. Yet, they pose a substantial long-term risk because the heaps are a potential source of large tonnage of

7L some of these contaminants. Because the heaps will be on public lands, the BLM will then potentially be responsible for long-term management of a contaminated site and the public will pay the bill.

### RESPONSE 7K

On page 4-77 of the DEIS, increased loading of some elements found in the discharge water is discussed, including loading to Rye Patch Reservoir and the Humboldt Sink. Several physical and chemical processes are listed that would influence actual trace element loading. The dynamic nature of these factors makes it difficult to predict actual loads that would reach lower portions of the Humboldt River Basin. See Response 5F to the U.S. Environmental Protection Agency (USEPA) letter for a discussion of loading calculations to the Humboldt River from the mine discharge water. During the relatively short mine water loading period of 12 years (1995 through 2006), loading would increase to the Humboldt River. After dewatering ceases and the flows in the Humboldt River decrease by up to about 200 gpm (0.45 cfs), natural loading in the Humboldt River would decrease below pre-mining levels.

As a result of the discussion above and in Response 5F to the USEPA letter in this FEIS, potential effects on human health, fish, wildlife, and vegetation from mine discharge water loading to the Humboldt River are expected to be minimal. For the relatively short duration of mine water discharge, concentration of the discharge water is more important that loading with respect to potential impacts. Concentrations of constituents in the discharge water are not expected to have adverse effects.

### RESPONSE 7L

The description of leach pads on page 2-45 is a general reclamation overview of these facilities. Leach pads would be decommissioned in accordance with NDEP requirements outlined in NAC 445A.430. Heap leach reclamation criteria include rinsing the ore pile with water to reduce cyanide concentrations to 0.2 milligrams per liter or less and maintaining the pH of rinse solution between 6 and 9 standard units. Predicted impacts on water resources from the leach pads is discussed on page 4-39 of the DEIS. The leach pads are not located on public land.

With respect to long-term risk of the heaps being a potential source for release of contaminants other than cyanide, an important condition of the site is that there should be little or no moisture or water developing on and moving through the leach pads because of low precipitation in this area. Without sufficient water to move metals or other constituents from the heaps to the subsurface and groundwater, no impacts could potentially occur.

7M The EIS should specify what concentrations of each of these contaminants will be allowed in drainage water from the heaps. It is insufficient to state that the state regulates these contaminants. The decision is a federal decision, and the BLM must take

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responsibility for ensuring that the closure of these operations does not pose a long-term risk. If those regulations are not yet in place, the BLM should take a conservative approach and use drinking water standards, or aquatic habitat standards for setting the water quality that will be required prior to closure. The DEIS does not meet the standards required in NEPA for a full discussion of the impacts unless a clear statement is presented on the concentration and total mass of various contaminants which will be permitted from the heaps. The Leach Pad discussion on page 2-45 is general, vague and insufficient.

Use of the Meteoric Water Mobility Procedure is mentioned several times throughout the document. The use of this method for assessing drainage water quality has never been established by any research and remains a poor test for assessing long term impacts on areas which will receive the discharge. We have made comments such as these
7N previously. If the method is valid in a federal agency decision, that federal agency needs to show that this method indeed has utility and provide an indication that a federal regulatory agency has considered this method and accepted it for the purposes being used. Without that demonstration, reference to this method should be entirely removed.

V. **Reclamation**

*1.* Although goals are presented, we were unable to locate any firm discussion on revegetation levels that would be *required.* The Federal Land Policy and Management Act requires the agency to prevent "undue and unnecessary degradation" of the public land. Accepting anything less than 100 percent is unnecessary, since the 100 percent
7O standard can be easily obtained. The company should be required to bring the land back to near that of the ecological potential.

*2.* No discussion is presented on the reclamation bond which would required and how the reclamation bond would be calculated. This lack of discussion is entirely unsatisfactory. Although the State of Nevada cannot require a bond for heap decommissioning, the BLM
7P is required to bond for complete reclamation. There was no discussion on whether such a bond would be required and the DEIS does not provide any indication of what that bond covers or how it will be administered. How will the bond be held? Since the state does not bond for heap rinsing, the BLM needs to establish a separate bond, which should be a full bond for the costs and not allow for the "corporate guarantee" allowed by the state. The BLM should use standard federal methods for bonding. A clear and detailed discussion of how the bond will be developed, who will hold the bond and what are the release criteria must be provided. This is central to assessing impacts.

**RESPONSE 7M**

Heap leach pad rinsing will be covered under the permanent closure plan that must be submitted two years prior to mine closure. As described on page 2-45 of the DEIS, SFPG would circulate and rinse heap leach pads until the criteria contained in NAC 445A.430 are met.

**RESPONSE 7N**

BLM concurs with findings regarding the use of the Meteoric Water Mobility Procedure contained in Response 09-16 to the Sierra Club letter #9 of the Final Environmental Impact Statement for the Round Mountain Mill and Tailings Facility (BLM 1996). The Meteoric Water Mobility Procedure is used by NDEP as the method to determine effects of normal weathering on earth materials and to predict resultant leachate from these materials.

**RESPONSE 7O**

The Reclamation section of the DEIS on page 2-40 (2nd column, last paragraph) lists the reclamation and revegetation goals, including achieving as close to 100 percent of the perennial plant cover of selected vegetation communities or reference areas as possible (Instruction Memorandum No. NV-94-026). Test plots at the Lone Tree Mine are in place. See Response 5Y to the U.S. Environmental Protection Agency letter in this FEIS for additional information.

**RESPONSE 7P**

At the present time, a reclamation bond (NAC 519A.350) is maintained by the State of Nevada to ensure reclamation of land disturbed by current operations at the Lone Tree Mine. The BLM would hold the bond when mining on public land is approved, while NDEP would maintain the corporate guarantee. Bonding requirements are addressed in NAC 519A.

The bond amount is based on the estimated cost of executing the reclamation plan which would be incurred by the State of Nevada or BLM having jurisdiction over the land. The bond amount will be adjusted to cover the expanded disturbance area associated with the Lone Tree Mine Expansion Project and additional reclamation costs. BLM has determined that additional bonding is not needed for heap leach rinsing because the facilities are located on private land.

VI. Water Quality

7Q 1. *Groundwater Quality:* The statement is made on pate 3-56 that "No aquatic life standards have been exceeded in the mine discharge water" This statement is false. The Lone Tree mine has violated the temperature standard several times over the past two years. It has almost certainly violated the boron standard for protection of wildlife that

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was in place prior to November of 1995. That standard has now been relaxed to 0.75 mg/L, although it is very possible that this standard may also be violated, since one of the discharge reports showed 0.7 mg/L of boron in water during the previous two years (8/30/94- data from the State Health Laboratory). Additionally, strong evidence is available that some aspect of the Lone Tree discharge was involved in a mass loss of macroinvertebrates during the winter months of 1994-95.

7R The boron issue is particularly problematic, particularly since it is both a direct problem of Lone Tree discharge, but also a cumulative issue from other mines (i.e. Betze Post proposed discharge) and clearly requires further analysis. The mine also needs to regularly monitor for boron and supply those data to the BLM and the State of Nevada, even though the mine was issued a permit without the boron monitoring requirement. That discharge permit was issued without sufficient public notice, even though the permit application was requested (but not sent prior to issuance) of the Division of Environmental Protection last Fall. We suggest that Lone Tree is contributing to the boron loading in the river and is at least partially responsible for exceedance of the agricultural standard downstream, which has occurred at least once in the previous two years. Very little data have been produced on boron discharges from Lone Tree, but of the data observed, the agricultural standard has nearly been exceeded. Because the Lone Tree Mine discharge will be a major portion of the Humboldt River flow during several months of the year, it is very likely that the agricultural standard for boron will continue to be exceeded. If that is the case, the discharge of boron should be reduced sufficiently that the mine is not contributing to the violations. The BLM should specify that the Lone Tree Mine should use their "chemical precipitation methods" (see above) to remove boron. They should also specify exactly which methods will be used and provide a clear description of those methods.

7S A second issue is sulfide. It is clear that this water contains appreciable concentrations of hydrogen sulfide. Data from the mine submitted to the Division of Environmental Protection indicated that hydrogen sulfide existed in some wells at concentrations exceeding 1 mg/L. This substance (as $H_2S$) has a toxicity similar to cyanide. Although a study was requested on sulfide from the dewatering operation, no study was ever submitted on subsequent analyses of the sulfide concentrations in the groundwater or the fate of hydrogen sulfide when that water was sent to the Humboldt River. We note that one sample of the discharge water did show the presence of hydrogen sulfide, although it was only one sampling point. We also recognize that the one sample that was taken of the discharged water last summer did not indicate the presence of sulfide. We request that the BLM require routine monitoring of sulfide in the discharge with a limit of detection of 2 parts per billion. That detection limit has been achieved by the Desert Research Institute and can be routinely met. We might also add that it now appears that temperature of the discharged water from Lone Tree is also implicated in the potential loss of macroinvertebrates from the River during the 1994-95 winter season.

**RESPONSE 7Q**

The summary of mine dewatering discharge water quality and related standards in Table 3-20 has been revised and is included in the Errata section in Chapter 3 of this FEIS. Boron was added to the NPDES monitoring requirement in 1996 with a discharge limit of 0.75 milligrams per liter. Since that time, no exceedances of the standard are known to have occurred for boron in the mine discharge water (see Response 7R below). The cooling pond and arsenic treatment plant have rectified any potential problems associated with arsenic and temperature in the discharge water. See Response 7J to this Sierra Club letter in this FEIS for a discussion of the macroinvertebrate issue related to mine discharge to the Humboldt River; there is no evidence that the Lone Tree Mine discharge was involved in a mass loss of invertebrates in the river.

**RESPONSE 7R**

Discharge limitations for various chemical constituents are established by NDEP for the NPDES permit. Boron was added as a parameter to be monitored in the Lone Tree Mine discharge water in April 1996. Concentrations of boron measured in the discharge water during January and February of 1996 range from 0.677 to 0.729 milligrams per liter (mg/L). Boron will continue to be monitored on a regular basis. See Response 7Q above for additional information.

**RESPONSE 7S**

As stated in Response 7R above, discharge limitations and monitoring requirements are established by NDEP for the NPDES permit. Sulfate is included as a parameter to be monitored in the discharge water; however, sulfide is not required by NDEP to be monitored. As stated on page 2-26 of the DEIS (2nd column, 3rd paragraph), SFPG voluntarily measures hydrogen sulfide gas periodically at the discharge pipes. This gas oxidizes rapidly in the atmosphere; therefore, any sulfide in the discharge water is expected to quickly decline as the water travels in the ditch and cooling pond system. See Response 7J to this Sierra Club letter in this FEIS for a discussion of the macroinvertebrate issue related to mine discharge to the Humboldt River. The existing cooling pond is reducing the discharge water temperature to within the current standard and NPDES permit limit.

*2. Pit Lake Water Quality*

7T Very little information is available on the pit water model used for this mine. A copy of that background report was requested, but it was not available. Thus, we are unsure of how that model was developed or the assumptions used for the model. However, the results are questionable, at best. This pit lake is reported to be initially acidic, followed by long term neutralization by carbonate in the wall rock. An example such as this is available from one of the Getchell mine pit lakes, which formed in the late 1960's and evolved until at least 1983. Since that time the pit was dewatered and is now being mined. The water quality in the North Pit is very poor, with sulfate concentrations in excess of 1500 mg/L and arsenic concentrations of 0.38 mg/L in 1982. These concentrations were approximately the same (within 15%) from 1968 to 1982, a period of 14 years. The model of Lone Tree pit lake predicts sulfate and arsenic concentrations to decrease over the 10-year period by 20% and 80%, respectively, which was not observed in the Getchell Mine. It also predicts iron concentrations after 10 years to be 0.04 mg/L. None of the pit lakes that we have seen (except possibly for the Kimbley Pit in the

7U Robinson District) contain iron concentrations that low.. We are not suggesting that these pit modeling results are necessarily wrong; we are suggesting that they are inconsistent with actual pit lakes in similar unoxidized rock, and the modeling results in this case represent only one result in a very large array of possible results.

**RESPONSE 7T**

The PTI report (Assessment of Pit-Lake Chemogenesis and Waste-Rock Characterization at the Lone Tree Mine, Nevada) is comprehensive and describes how the model was developed and the associated assumptions. This report has been available for review at the BLM office in Winnemucca since the DEIS was issued for public review. The PTI (1994) report was incorrectly referenced in the DEIS, with the correct citation as follows: *PTI Environmental Services (PTI), 1995. Assessment of Pit-Lake Chemogenesis and Waste-Rock Characterization at the Lone Tree Mine, Nevada. Prepared for Santa Fe Pacific Gold Corporation, Valmy, Nevada. January 1995* (see the Errata section in Chapter 3 of this FEIS). Another report, *"Revised Prediction of Water Quality in the Lone Tree Mine Pit Lake"* (PTI 1996), has been prepared to incorporate new information since the DEIS was released; this report is also available at the Winnemucca BLM office for review. Summaries of these pit lake studies by PTI are included in Appendix D of this FEIS.

**RESPONSE 7U**

A revised prediction of pit lake water quality performed by PTI (1996) shows that sulfate and arsenic concentrations do not decrease over time (see revised Table 4-5 in the Errata section in Chapter 3 of this FEIS). A summary of the PTI pit lake studies is in Appendix D in this FEIS. Evaluation of other pit lakes in Nevada may be a useful method of comparison for physical characteristics such as groundwater inflow and evaporation rates; however, the BLM believes that proper use of models and studies, along with good site-specific data as input parameters, should be a superior method of water quality prediction than the use of existing water quality from other pit lakes.

7V Additionally, the recently released final EIS on the Pipeline project shows a pit lake chemistry that was modeled by a different group. The assumptions used were different and the evolving chemistry is also different. While we recognize that different geology and groundwater will affect pit lakes differently, the belief that these models will predict pit lake chemistry well into the future has no basis, since verification of these models has not occurred. At the very least, the BLM should require that a separate and independent group at least attempt to also model this pit lake water quality. We would be surprised if the results came out even close, much less three significant figures, decades into the future. It is more reasonable to assume that the pit lake chemistry of Lone Tree is similar to the Getchell mine, and largely ignore the modeled pit lake chemistry. The Getchell Mine, or the Boss Mine or the Cominco Buckhorn Mine each are from unoxidized rock, similar to the Lone Tree mine. Real pit lake data are available from these mines, and unless these lakes have been correctly modeled, the models used for Lone Tree are probably sufficiently uncertain that they have no utility for making regulatory decisions. Estimating the pit lake chemistry based on the geological characteristics of the pit walls is a reasonable exercise, but until a level of verification has been accomplished, this exercise should not be used for any regulatory determination. We will argue that the modeling results are useful only for predicting pH and also to provide an indication of which elements may prove a problem. In this case, iron was slowly added to the pit lake in order to precipitate the arsenic. We are unaware of any pit lake in which this has been demonstrated. In the Getchell Mine, which contains large amounts of arsenopyrite, the iron was insufficient to remove arsenic, as suggested in the Lone Tree mine.

7W It is also likely that this pit lake will contaminate surrounding groundwater. In fact, the statement is made that the water will indeed migrate away from the pit. (page 4-38). It is very likely that drinking water standards for sulfate, selenium, arsenic, nickel,

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and fluoride will be violated. Thus, creation of this pit lake should not be allowed under Nevada regulations which prohibit forming a lake by mining which *threatens* to degrade groundwater quality.

**RESPONSE 7V**

Even though the complete pit lake geochemical model for the Lone Tree Mine has not been verified, several key components of the model have been widely used and verified for numerous applications. Humidity cell tests were conducted on core material representative of wall rock at the time of pit closure; the purpose of the tests was to ascertain the reactivity and leachability of metals from oxidized wall rock that would remain after mining. This information, in conjunction with wall rock oxidation rind thickness, was used to calculate bulk aqueous chemistry as the pit fills with water over time.

Final lake composition was calculated using the geochemical model *MINTEQA2*. To determine uncertainty in the calculations, the inputs into the final pit lake model were varied using Monte Carlo statistical techniques to calculate a potential distribution of final pit lake compositions. For the period after which the pit lake becomes full, the lake model *CE-QUAL-R1* was used to predict the distribution of thermal, chemical and biological parameters in the pit lake as a function of time. A summary of the PTI (1995 and 1996) pit lake study is included in Appendix D in this FEIS.

The BLM has been involved with the review of this model and believes it to be an adequate predictive tool for pit lake water quality. This model has been used at other mine projects, including the Gold Quarry Mine in Nevada. Geochemical modeling is based on conditions known to exist at the site and, therefore, is site-specific. Data from other mines often are used to supplement the model results for comparative purposes; however, the site-specific model, if performed properly, should be considered the best estimate of future pit lake conditions.

**RESPONSE 7W**

See Response 5A to the U.S. Environmental Protection Agency letter (and Appendix D) in this FEIS for information about predicted groundwater quality downgradient of the Lone Tree pit lake.

VII. Water Quantity

7X The major impact of the existing and proposed expansion of the Lone Tree mine is the impact on surface water resources nearby and on the Humboldt River. Although the DEIS devotes near the same space to several small springs and groundwater rights, these comments focus on the big picture which is exists, and future flows in the Humboldt River as impacted by Lone Tree both singularly and cumulatively. These comments focus on information provided and not provided in the DEIS concerning groundwater hydrology and modeling. The use of a "proprietary model" on this project is inconsistent with requirements in NEPA to require full disclosure of methods to assess impacts. We verbally requested a copy of the groundwater study, but were told that this study was not available for distribution. The major impact of this mine on the environment is almost certainly water withdrawal and water quality impacts. Yet this "proprietary" model indicates that 1.1 million acre-feet of deficit will not cause a significant impact on the Humboldt River. We are also told that we cannot independently review the basis for this model and the study is not available for review. We object, and argue that use of a proprietary model on this very important problem violates the intent and letter of NEPA.

7Y Who did the BLM have review the technical adequacy of the analysis? Other DEISs provide lists of reviewers. We are especially concerned about the groundwater hydrology. The DEIS relies on a proprietary finite element groundwater model developed by HCI. Where has this model been verified? The BLM should make available a summary groundwater report describing the groundwater modeling and hydrology. This has been done for other projects such as Cortez's Pipeline Deposit.

**RESPONSE 7X**

The "proprietary" groundwater flow model (referred to as *MINEDW*) by HCI (1994a) utilized in the DEIS for predicting impacts from the cone of depression around the Lone Tree Mine has been subject to considerable review. The basic core of the model originated in earlier code referred to as *FLOW3D* that was developed by Mr. Timothy J. Durbin when he was employed by the U.S. Geological Survey (USGS). Complete documentation of *MINEDW*, including a description of its mathematical basis, several validations of its problem-solving capabilities, and instructions for users, has been produced (HCI 1992). A description of *FLOW3D* is given in three USGS reports: Durbin and Berenbrock 1985; Durbin and O'Brien 1987; and Mitten et al. 1988.

The *MINEDW* model has been utilized at several mine sites in Nevada (e.g., Gold Quarry Mine) with oversight and review by numerous specialists and BLM staff. Dr. Thomas Olsen of BLM has reviewed and utilized this model for several years, including its application at the Lone Tree Mine. The model and its application to the Lone Tree Mine was also reviewed by Dr. William Woessner of the University of Montana for the BLM.

The HCI (1994a and 1995b) model reports have been available for review at the BLM office in Winnemucca since the DEIS was issued for public review. In addition, the report, *"Predicted Rate and Nature of Infilling of Lone Tree Pit Lake"* (HCI 1996b), has recently been completed that incorporates new information since the DEIS was released; this report is also available for review at the Winnemucca BLM office. A summary of these groundwater flow model reports is included in Appendix H in this FEIS.

**RESPONSE 7Y**

In addition to the water resources author of the EIS (Doug Rogness of Maxim Technologies, Inc.), Dr. Thomas Olsen of BLM and Dr. William Woessner of the University of Montana reviewed the technical adequacy of the groundwater flow model. Dr. Woessner's name was inadvertently left out of the List of Preparers and Reviewers in the DEIS (page 5-7) (see Errata section in Chapter 3 of this FEIS). Model recalibration will continue periodically during dewatering activities to refine model predictions. Dr. Terry Chatwin of Maxim Technologies, Inc. conducted the pit lake geochemical modeling review for the EIS preparation team. Expanded summaries of the groundwater flow and pit lake geochemical models are included in Appendices H and D, respectively, in this FEIS.

*Specific Comments:*

7Z

1. *Open pit:* At no point in the DEIS is the specific volume of the pit, either totally or below the pre-mining groundwater level, provided. Figure 2-8 is the only plan drawing of the pits, and the contours are not labeled and determination of volumes from this figure is difficult. Figure 2-10 shows reclaimed contours and a filled lake. The summary on page 4-7 indicates the area will be 384 acres with an ultimate depth of 900 feet. I assume this to be an average depth since figures in other parts of the DEIS vary from about 650 to 950 feet. The upper limit to the total volume is thus 345,000 acre-ft. However, this is not correct because the walls are not vertical. The lower limit occurs if the area at a depth of 900 feet is 0. Based on the formula for the volume of a circular cone, the lower limit is (1/3)(900)(384) or 115,000 acre-ft. The real volume is somewhere between these limits. Judging from Figure 2-8, the area of maximum depth is about 10% of the surface area. Adapting the formula for the frustrum of a cone, the volume is (1/2)(900)(384+0.1(384)) or 190,000 acre-ft. The important volume for water resource impacts is that below the

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groundwater level. Depth to groundwater before mining is uncertain from the DEIS, but, assuming it is 100 feet, the volume of pit water is about (1/2)(800)(384*.9+.1(384)) or 154,000 acre-ft. We acknowledge that this estimate is probably not accurate, but it is precise based on available information in the DEIS. We use it herein for discussion purposes only. Future documents should be very specific about these volumes. The cause for concern and need for accuracy is due to the fact that the pit volume that will be a lake represents a deficit to the basin in excess of dewatering pumpage. This will be further discussed below.

7AA

2. *Groundwater recharge:* On page 3-46, the DEIS quotes a letter report (PTI 1994) as a source for the groundwater recharge rate of 0.54 inches. On page 3-15, the DEIS states that the average annual precipitation ranged from 6 to 8 inches between 1915 and 1991. In the Maxey-Eakin method, this precipitation zone (6-12 inches) has about a 3% recharge. Based on 8 inches of precipitation, only 0.24 inches would recharge. However, recent research has questioned the credibility of Maxey-Eakin, suggesting an overprediction. The small mountains near the project site may have some zones of higher recharge, but the areal extent is limited. The DEIS is very unclear concerning total recharge to the groundwater from precipitation. Basically, there is no estimate of total recharge provided. A table with elevation, precipitation and recharge amounts is necessary.

7BB

3. *Dewatering:* Current dewatering rates are high and will become higher with the proposed project. The implications in the DEIS are that most dewatering comes from bedrock not connected to the alluvial aquifer or surface water source. On page 3-56, there is a statement that most pumpage is from the Wayne Zone. Table 3-19 lists qualities of water from 8 dewatering wells. Based on the fact that only two of these wells are in the Wayne Zone and that three are in alluvium, it is very difficult to accept that most dewatering is from bedrock. Evidence should be provided to back up this claim. This could include detailed pumpage hydrographs for each of the wells as well as copies of the well log so that the reader can assess the geology of the area.

**RESPONSE 7Z**

Comment noted. A pit lake volume of approximately 102,000 acre-feet was calculated for geochemical modeling studies (PTI 1996).

**RESPONSE 7AA**

In the DEIS, the average annual groundwater recharge rate of 0.54 inches from precipitation was obtained from HCI (1994a). In this report, HCI provides a table (see Appendix L in this FEIS) that summarizes the distribution of recharge and precipitation relative to various elevations across the study area. In their analysis, HCI assumed that there was no recharge attributable to precipitation at elevations below 4,600 feet, and more than half of the recharge from precipitation occurs at elevations higher than 5,700 feet. The BLM has satisfied its obligation under the CEQ regulations to independently review the HCI model reports. See Responses 7E and 7Y above.

**RESPONSE 7BB**

The three wells completed in alluvium that are included in Table 3-19 of the DEIS (page 3-57) are not dewatering wells, but are monitoring wells. This table presents a summary of groundwater quality in the vicinity of the Lone Tree Mine. The majority of dewatering wells and associated water production are from bedrock in or near the Wayne Zone. The number of dewatering wells completed in alluvium varies over time depending on the amount of alluvium encountered by the mine pit; however, the number of these wells and the quantity of water pumped from them is very small compared to the dewatering wells completed in bedrock. HCI (1996a, 1996b) conducted a model to predict the magnitude of groundwater inflow to the pit lake after cessation of mining. This study also confirms that the majority of water comes from the Wayne Zone (65%), Havallah Formation (30%), and the Valmy Formation (5%). An insignificant amount of total inflow comes from alluvium.

7CC 4. *Groundwater Model*. First, see the general comments above concerning model reliability and public review. The DEIS relies solely on proprietary reports, including letter reports and referenced facsimiles for its documentation. The DEIS should summarize the modeling effort. How was it calibrated? What time and stress periods were used? What about boundary conditions? How is the connection between alluvium and bedrock modeled? A few figures and pages of summary would go a long way toward helping the reviewing public understand the model even if they do not want to study a detailed report, as we do.

7DD 5. *Humboldt River in the groundwater model*: The DEIS stated that the Humboldt River is connected to the groundwater system. It seems that the river should be modeled as a constant head boundary (see comment 4). However, drawdown contours indicate a disconnection from the water table. This probably affects the estimate of loss from the river, both due to dewatering and during pit refill.

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7EE 6. *Groundwater deficit*: This project creates a large deficit in the groundwater basin. Page 4-8 states that an additional 0.6 million acre-ft of groundwater will be withdrawn from groundwater and discharged to the Humboldt River, this represents a long-term deficit. It is in addition to the deficit created by the existing permitted project. Along with the pit volume and existing projects, the total deficit is near 1,000,000 acre-feet. Page 4-12 states that groundwater in the mine pit will recover to 90% within 23 years. Assuming this estimate is correct (and there are many variables that lead to uncertainty in the estimate) and recognizing that the drawdown cone will expand laterally even while the depth decreases rapidly (ie Figures 4-4 and 4-5), the implication is that much of the deficit will be made up by this time. The DEIS (page 4-32) states that the decrease in the Humboldt River is only 0.45 cfs during refill. Assuming that all of this loss goes to the replenishing the deficit, only (0.45cfs)(86400s/d)(365d/yr)23yr/43560, or 7493 acre-ft will go to this deficit. By necessity, the remainder comes from precipitation recharge. If only half is made up in 23 years, approximately (1/2(1,000,000)-7493) or 492,500 acre-ft will come from precipitation. Accepting the estimate of 0.54 inches/year (however, see comment 2), the complete recharge for 23 years is 12.42 inches or 1.035 feet. Thus, the complete recharge from 492,500/1.035 or 475,800 acres will go to recharging just one half of the deficit in 23 years. This is much larger than the basin area considered in the DEIS. Therefore, it is very difficult to accept that flow will decrease just 0.45 cfs the Humboldt River.

**RESPONSE 7CC**

A summary of the groundwater flow model (HCI 1994a, 1995b, 1996a, 1996b) is included in Appendix H in this FEIS. See Response 7X above for additional information.

**RESPONSE 7DD**

The Humboldt River (and the Iron Point Relief Canal) were simulated using the *RIVER* subroutine in *MINEDW*. This subroutine calculates discharge from or to the groundwater system based on the hydraulic gradient between the river and the water table and the leakance factor of the river bed (HCI 1994a). If the Humboldt River were simulated using constant head nodes, the elevation of the water table in the upper-most model layer would remain constant, regardless of the effects of dewatering.

**RESPONSE 7EE**

Groundwater discharged to the Humboldt River during the operational period of the mine project does not constitute a groundwater deficit in the Humboldt River drainage basin. Instead, dewatering operations associated with the Lone Tree Mine and the subsequent discharge of the water to the Humboldt River represent redistribution of the water within the basin. The smaller drainage sub-basin that contains the Lone Tree Mine site would experience a groundwater deficit from dewatering during the life of the mine. After dewatering ceases, some groundwater would be lost to evaporation from the pit lake (see Response 8P to the U.S. Fish and Wildlife Service letter in this FEIS).

The estimated seepage loss of 0.45 cfs from the Humboldt River does contribute to recharging the cone of depression, as does precipitation. However, the majority of recharge to the cone of depression is attributable to lateral recharge from bedrock aquifers surrounding the dewatered area.

The volume of seepage loss in the Humboldt River is a function of the head in river, the geometry of the stream channel, the leakance of the stream bed sediments, and the hydraulic gradient between the head in the river and the receiving groundwater system. The volume of water lost from the Humboldt River to groundwater is not dependent on the volume of unsaturated material within the cone of depression.

7FF

*7. Losses to the Humboldt River:* In comment 6, we used water balance calculations to question the estimate of long-term loss to the Humboldt River. The DEIS states the alluvium contains very clayey soils, but also lenses of gravel and sand. The implication is that clay will isolate the river from the groundwater. However, there are no well logs showing clay lenses in the alluvium. Only a very few lenses of gravel or sand intercepting the bottom of the river would allow for substantial groundwater recharge from the river. These lenses could be much smaller than the elements in the groundwater model and effectively missed in the model. Also, the DEIS states there is a loss of 8 cfs between the Battle Mountain and Comus gage (page 3-46). (However, the gradient appears to be toward the river in Figure 3-12). The gradient from the river to the groundwater will increase (all the way to 1 if the water table pulls below the bottom of the river) due to dewatering. It is very difficult to accept that groundwater recharge from the river will only increase by 0.45 cfs to 8.45 cfs or only 5.6% when the gradient will increase by orders of magnitude.

7GG

*8. Cumulative impacts:* The cumulative impacts (page 4-76) are inadequately discussed. The document should contain a table showing total pit and drawdown cone deficits for all mines in the Humboldt basin. This should also include information on total flows, groundwater and surface water, and aquifer storages and properties in the basin. The combination of deficits, existing flows, and groundwater storage should provide a picture of overall impacts. However, see our summary comments as well.

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7HH

*9. Impacts on the agricultural users in Lovelock:* How will data be collected so that the farmers in the Lovelock area will know with a high reliability when their water quantity is being impacted. How will this mine ensure that those impacts are compensated? Who will pay for these studies, which will occur after the mine has gone. Will the BLM require a long-term fund to pay for these studies. When the pumps are turned off and the mining company goes away, what recourse will the farmers have if they suspect that 10-20% of the water they had previous to the mine is now pouring into the ground to recover the 1.1-1.2 million acre-feet of deficit that will have been created. You may argue that this issue is a State of Nevada problem, but the State Engineer appears to be ignoring the problems which may be created by the dewatering rate on agriculture and the BLM has the responsibility to protect those impacted by this BLM decision.

**RESPONSE 7FF**

Review of completion logs for wells drilled near the Humboldt River indicate alluvial material in the area ranges in thickness from 15 to 40 feet and consists of interbedded silt, sand, and gravel with occasional clay layers. Alluvium in the area is underlain by a relatively thick (greater than 100 feet) sequence of lakebed sediments composed of clay. The presence of poorly sorted silty alluvium, combined with an underlying thick sequence of clay lakebed sediments, will collectively serve to limit the rate of vertical infiltration from the Humboldt River.

Water table contours plotted on Figure 3-12 in the DEIS (page 3-49) indicate groundwater flows toward the Humboldt River; however, the water table contours do not intersect the elevation of the stream bed and, therefore, groundwater is not currently recharging the Humboldt River. As discussed in Responses 7DD and 7EE above, the rate of seepage from the Humboldt River is dependent on head in the river, geometry of the stream channel, leakance of the stream bed sediments, and hydraulic gradient between head in the river and the receiving groundwater system.

**RESPONSE 7GG**

BLM believes that the cumulative effects analysis, as presented in the DEIS, accurately presents the potential cumulative effects associated with the Lone Tree Mine Expansion. See Response 7F for additional information about the cumulative effects analysis in this EIS.

**RESPONSE 7HH**

The State of Nevada maintains jurisdiction over beneficial uses of water and can mandate replacement of water supply for water sources which become impaired as a result of activities within the hydrologic basin.

Discharge of water from the Lone Tree Mine dewatering project will increase the volume of water in the Humboldt River that is available to recharge aquifers adjacent to the Humboldt River. This recharge likely would increase the amount of water available to other water users downstream of the project. SFPG will be responsible for monitoring the Humboldt River during and after the mining period until the agencies determine that impacts are no longer of concern. Water quantity impairment issues would be addressed by the State Engineer.

*Summary of Water Resources Impacts*

7II The existing and proposed Lone Tree mine will have substantial impact on the short-term and long-term flows on the Humboldt River. Although the increased flows in the short-term may have limited positive impacts on certain aquatic species and water rights, the long-term effects on flow in the river are likely to be substantial. We believe the analysis provided in the DEIS is incorrect in its final estimates. Much more information is required to substantiate the conclusions. Reference to proprietary models, reports, letters and facsimiles is inappropriate and inadequate analysis of the impacts.

7JJ The cumulative impacts of dewatering deficits in the Humboldt River basin are substantial and the BLM must provide leadership on a project to assess these impacts. The study should include substantial pump testing, seismic testing, flow studies, dye studies and groundwater modeling of the impacts. We believe that no more mines, including the Lone Tree Expansion, that require dewatering, should be permitted in the Humboldt River basin until such a study is concluded.

Thank you for the opportunity to provide these comments.

Sincerely,

Glenn C. Miller, Chair of the Mining Committee
Toiyabe Chapter of the Sierra Club

cc: Sierra Club Legal Defense Fund

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**RESPONSE 7II**

Comment noted. See previous responses to Sierra Club comments in this letter.

**RESPONSE 7JJ**

Comment noted. See previous responses to Sierra Club comments in this letter.

## Letter #8

United States Department of the Interior

FISH AND WILDLIFE SERVICE
NEVADA STATE OFFICE
4600 KIETZKE LANE, BUILDING C-125
RENO, NEVADA 89502-5093

February 16, 1996
File No. CCU-96-0263
BLM 16-4

Memorandum

To: EIS Project Manager, Winnemucca District Office, Bureau of Land Management, Winnemucca, Nevada (Attn: Gerald Moritz)

From: State Supervisor, Nevada State Office, Reno, Nevada

Subject: Lone Tree Mine Expansion Project Draft Environmental Impact Statement

The Fish and Wildlife Service (Service) has reviewed the December 1995 draft environmental impact statement (DEIS) for Santa Fe Pacific Gold Corporation's Lone Tree Mine Expansion Project. The DEIS analyzes impacts associated with the expansion of existing gold mining operations on a site approximately 34 miles east of Winnemucca, in northern Humboldt County, Nevada. The project would expand the existing open pit; continue mine dewatering with effluent discharge to the Humboldt River; expand the mill tailings impoundment; and expand the overburden disposal facility. The mine expansion will disturb an additional 1,024 acres of land beyond that of the current project.

GENERAL COMMENTS

The Service is concerned with the limited description of the Proposed Action and the lack of information made available to the reader. Numerous instances occur where data that may be available were not utilized in generating predictions of whether the Proposed Action will or will not have significant impacts to biological resources in or near the study area. We recommend that these data sources be examined and that any applicable information currently available be used to predict what impacts, if any, the Proposed Action may have on biological resources in the area.

8A The Service is concerned that the DEIS may underestimate the impacts of the project. This includes potential adverse impacts to surface water quality. The analysis should include the deposition of trace elements from water to sediments in the cooling pond and the potential redistribution of these sediments downstream in the event of a flood washing out pond dikes. The analysis also should include loading of total dissolved solids and trace elements discharged to the Humboldt River from mine dewatering effluent, with information on potential impacts to aquatic species and birds.

8B The DEIS also appears to underestimate risks to wildlife related to development of the pit lake. The DEIS should clearly analyze potential risks associated with possible establishment of aquatic communities and the likely introduction of fish in the pit lake. Risks to birds, especially fish-eating species, associated with uptake of trace elements through the food chain should be addressed.

8C Finally, a variety of cumulative impacts are not adequately addressed. First, the geographic area evaluated for fisheries and aquatics includes the Humboldt River near Carlin to Rye Patch Reservoir. The area of evaluation should include all areas in which current and future dewatering discharges will reach the Humboldt River. This is needed to assess potential cumulative impacts of increased loading of trace elements to the river, including terminal wetlands.

8D We recommend that two environmental risk assessments be conducted, one for the pit lake and a second for dewatering effluent discharges to the Humboldt River. The results from these risk assessments should then be incorporated into the final EIS.

We appreciate the opportunity to comment on the DEIS for this project. Specific comments on issues of concern are provided as an attachment. If you have any questions, please contact Stanley Wiemeyer, Tom Kennedy, or Mary Jo Elpers at (702) 784-5227.

Carlos H. Mendoza

Carlos H. Mendoza

Attachment

cc:
Administrator, Nevada Division of Environmental Protection, Carson City, Nevada
Administrator, Nevada Division of Wildlife, Reno, Nevada
Regional Manager, Nevada Division of Wildlife, Fallon, Nevada
Project Manager, Army Corps of Engineers, Reno, Nevada
State Director, Bureau of Land Management, Reno, Nevada
Chief, Office of Federal Activities, Environmental Protection Agency, San Francisco, California
Chief, Wetlands Section, Environmental Protection Agency, San Francisco, California
Assistant Regional Director, Ecological Services, Fish and Wildlife Service, Portland, Oregon
Assistant Regional Director, Interior Basin Ecoregion, Fish and Wildlife Service, Portland, Oregon

(all w/atch.)

**RESPONSE 8A**

Deposition of trace elements from water to sediments in the cooling pond(s) is not expected to be a problem because of the relatively low concentrations of trace elements in the water and the limited duration of cooling pond use (approximately 12 years). Redistribution of these sediments as a result of flood water from the Humboldt River is not likely because the pond dikes or berms are 9 to 14 feet high, and any flood water that may reach the pond site would have relatively low velocities that should not erode the dikes. See Response 8JJ and 8KK in this FEIS for additional information.

**RESPONSE 8B**

See Response 5B to the U.S. Environmental Protection Agency letter in this FEIS for information about potential impacts to wildlife from the pit lake and possible establishment of aquatic communities and likely introduction of fish in the pit lake; risks to birds associated with uptake of trace elements through the food chain are also included in Response 5B. Also see Appendix E for an expanded summary of the ecological risk assessment report; the complete risk assessment report (ENSR 1996) is available at the BLM Winnemucca District office.

**RESPONSE 8C**

See Response 5F to the U.S. Environmental Protection Agency letter and Responses 7F, 7G, and 7GG to the Sierra Club letter in this FEIS for information about the adequacy of the cumulative effects analysis contained in the DEIS for the Lone Tree Mine.

**RESPONSE 8D**

An ecological risk assessment has been completed which addresses final pit lake water quality at the Lone Tree Mine. Appendix E contains a summary of the risk assessment. Given the relatively short life of the discharge (12 years) and the fact that discharge water must meet State of Nevada water quality standards for the NPDES permit (standards which are established at levels protective of human health and the environment), a risk assessment addressing mine water discharge to the Humboldt River is not necessary.

ATTACHMENT

Lone Tree Mine Expansion Project Draft Environmental Impact Statement

SPECIFIC COMMENTS

CHAPTER 2. DESCRIPTION OF THE PROPOSED ACTION AND ALTERNATIVES

8E Existing Operations, Flotation Circuit. Pages 2-20 to 2-21. The Draft Environmental Impact Statement (DEIS) states that a portion of the concentrates from the flotation circuit will be shipped to the Twin Creeks Mine or another offsite facility for final processing. This statement is in conflict with a statement in the Summary which indicated that concentrates will go to the Mule Canyon mine.

**RESPONSE 8E**

Flotation concentrates will be shipped to SFPG's nearby Twin Creeks Mine or other off-site facilities for final processing. A correction to page S-1 of the DEIS in the SUMMARY section is included in the Errata section in Chapter 3 of this FEIS.

8F Existing Operations, Water Supply/Mine Pit Dewatering, Pages 2-22 to 2-25. The last paragraph describes the water treatment plant for removal of arsenic from dewatering effluent. Although construction of the plant is not part of the Proposed Action, it will be in operation throughout the proposed expansion of the mine. The final EIS should indicate measures that will be taken to exclude birds and mammals from this pond. Mortality of birds at such a pond could be considered a violation of the Migratory Bird Treaty Act.

**RESPONSE 8F**

Water held in the cooling ponds or treated and released from the arsenic treatment plant would contain levels of metals and other elements at concentrations in compliance with effluent limits established by NDEP in the NPDES permit (see page 4-35 of DEIS; see revised Table 3-20 in the Errata section of this FEIS). Residence time of water in the cooling ponds would be approximately 8 days; as a result, metals or other elements of concern would not increase in concentration due to evaporation, stagnation, and/or precipitation.

The Migratory Bird Treaty Act does apply to the cooling and water treatment ponds. There are no elements in the cooling pond water at concentrations that are or would be sufficiently high to adversely affect mammals, birds, fish, or other aquatic organisms (see Responses 8A and 8JJ for additional information). The arsenic treatment plant ponds will be fenced to keep out larger mammals, but will not be netted for protection from birds. The ponds also will be lined which prevents vegetation growth along the pond perimeter and minimizes attraction to birds. Concentrations of arsenic in the arsenic treatment ponds should not be a problem to birds based on results of an ecological risk assessment that was completed for the pit lake (see Appendix E). Arsenic concentrations that would occur in the treatment plant ponds are lower than those predicted to occur in the mine pit lake.

8G Existing Operations, Resource Monitoring, Water Resources. Pages 2-26 to 2-27. The previous section of the DEIS, involving air quality, describes monitoring of hydrogen sulfide gas emanating from pit dewatering discharges. Hydrogen sulfide is extremely toxic to aquatic organisms. The final EIS should include monitoring of hydrogen sulfide in water or provide a rational basis as to why this is not necessary. Monitoring should be conducted, at least initially, at the point where dewatering discharge canals empty into the Iron Point Relief Canal, near the Humboldt River. If hydrogen sulfide, at toxic concentrations, is not detected under a variety of water temperature conditions over a period of time, it may be reasonable to terminate hydrogen sulfide monitoring at this location. The final EIS should describe corrective actions in the event that hydrogen sulfide is found in water.

**RESPONSE 8G**

Hydrogen sulfide oxidizes rapidly in the environment when the discharge water flows into the canal and cooling pond system. Concentrations vary over time in the discharge water and are not expected to be toxic to aquatic organisms. SFPG would continue to voluntarily monitor hydrogen sulfide gas emanating from water at the discharge canals; hydrogen sulfide levels in the air near the discharge water indicates that hydrogen sulfide may have been present in the discharge water. Corrective action is not anticipated for hydrogen sulfide in the discharge water based on concentrations measured to date. In addition, whole effluent toxicity (WET) testing is conducted quarterly at the Lone Tree Mine. The WET is conducted and resultant data are evaluated according to methods established by the U.S. Environmental Protection Agency (e.g., EPA/600/4-85/013). The WET method is used to evaluate potential toxicity to aquatic life and fish in surface water below the Lone Tree Mine discharge point.

8H Existing Operations, Resource Monitoring, Potentially Acid-Producing Rock, Page 2-27. The DEIS, in the second paragraph indicates that overburden disposal facilities have the potential to mobilize several contaminants, including trace elements, but the predicted concentrations are less than drinking water standards. The Fish and Wildlife Service (Service) recommends that the predicted concentrations also be compared to aquatic life standards, some of which are more restrictive than drinking water standards. Also, information is lacking in this section on how the predictions were made. This information is essential to our evaluation.

8I Existing Operations, Resource Monitoring, Wildlife, Page 2-27. This section describes the reporting of wildlife mortalities to the Nevada Division of Wildlife (NDOW); however, there is no indication as to how the mine separates cyanide related mortality from non-cyanide related mortality. Just because a bird or mammal dies away from a source of cyanide

exposure does not necessarily mean that the animal was not lethally exposed. There is increasing evidence that some exposed animals may travel some distance before succumbing. Significant sublethal effects of cyanide exposure are also a distinct possibility. The final EIS should describe how the mine determines whether a vertebrate died of cyanide exposure or of some other cause.

8J Existing Operations, Aquatic Habitat, Page 2-27. The DEIS states that monitoring of aquatic habitat will include sampling of macroinvertebrates as a measure of stream habitat conditions. We suggest that this statement be reworded, as macroinvertebrate sampling is used as a direct biotic measure of water quality conditions (Winget and Mangum 1979), not stream habitat conditions. Other indicators such as composition of substrate, discharge, and riparian shading are used to evaluate stream habitat conditions more directly. This clarification will become important in later references to interpretation of this monitoring method (also see comments on Chapter 3: Affected Environment, Aquatic Habitat and Fisheries).

8K Proposed Action, Water Supply/Mine Pit Dewatering, Page 2-38. The DEIS refers to temperature standards in the Humboldt River. The State standards were recently changed. Specific information on current temperature standards should be provided here and at other appropriate places in the document.

8L Proposed Action, Reclamation, Mine Pit, Page 2-44. The DEIS indicates that the mine pit would not be regraded and would remain in the final mining configuration. It is not prudent to leave benches or ramps on the pit walls near the elevation of the predicted final surface level of the pit lake because of the possible establishment of lentic communities. Such communities would provide for establishment of biota that would bioaccumulate and/or biomagnify trace elements and provide food sources for migratory birds. Under such conditions the risk of adverse effects from contaminants to migratory birds is greatly multiplied. Alternative configurations of the pit walls should be addressed in this section. The ultimate expected effects of pit wall configuration to wildlife should be addressed elsewhere in the document.

**RESPONSE 8H**

Aquatic life standards are not applicable to the overburden disposal facilities because there is no surface water nearby that could be impacted by water leaching through the material. The overburden material has a net acid neutralization potential and is underlain by alluvium that also has a net neutralization potential. In addition, there is not sufficient precipitation in this area to likely cause leaching from the overburden material. Monitoring of groundwater wells in the vicinity of the overburden disposal facilities would confirm the presence or absence of impacts.

See Response 5H to the U.S. Environmental Protection Agency (USEPA) letter in this FEIS (and Appendix G) for additional information about the acid producing potential of rock at the Lone Tree Mine. See Responses 5L and 5M of the USEPA letter and the Errata section in this FEIS for a revision of the section on page 2-27 of the DEIS titled Potentially Acid-Producing Rock.

**RESPONSE 8I**

Reporting requirements to the state for cyanide exposure mortality of vertebrates are based on whether or not the mortality was associated with pond solutions or a permitted structure, or if it was not related. No testing of the animal is conducted.

**RESPONSE 8J**

Macroinvertebrate studies provide a measure of water quality conditions, a critical habitat component for macroinvertebrates and other aquatic organisms. It is recognized that other habitat elements such as discharge, substrate composition, and shading also influence the numbers and diversity of macroinvertebrates.

**RESPONSE 8K**

The water temperature standards for Nevada have not yet been changed by NDEP.

**RESPONSE 8L**

Aquatic organisms likely would not colonize in the final pit lake at the Lone Tree Mine; therefore, alternative configurations of the pit walls are not deemed necessary (see Response 5B to the U.S. Environmental Protection Agency letter in this FEIS; also see the summary of the ecological risk assessment contained in Appendix E in this FEIS).

8M <u>Proposed Action, Reclamation, Tailings Impoundment Facility. Page 2-44</u>: The second paragraph of this section indicates that samples of tailings material will be collected and subjected to the Meteoric Water Mobility Test procedure and that static and kinetic tests would determine which constituents could leach from the material under normal weather conditions. The document should state how information from these tests will be used. This comment also applies to the section on cooling ponds and canals (page 2-46). Also, the tests should predict which constituents would leach from the material in other than normal conditions, especially exceptionally wet periods.

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8N <u>Proposed Action, Reclamation, Monitoring/Evaluation of Reclamation Success. Page 2-51.</u> The last sentence in this section indicates that revegetation will be considered successful when total perennial cover is as close to 100 percent of the perennial plant cover of selected vegetation communities or reference areas as possible. There may be widely varying opinions of what is possible. The document should provide a more specific statement of the goal.

8O <u>Project Alternatives, Opportunities. Pages 2-55 to 2-56.</u> The DEIS indicates that opportunities (listed later in the DEIS): Do not meet the purpose and need associated with the Proposed Action; do not address significant issues related to the Proposed Action; or are beyond the regulatory authority of the Bureau of Land Management (BLM). The Service disagrees with the premise that the opportunity to stock the pit lake with fish for sportsmen and wildlife does not address a significant issue related to the Proposed Action. The ecological risk assessment for the Cortez Gold Mine Pipeline Project pit lake indicated that the hazard of adverse effects to fish-eating birds was extremely high when fish were present compared to no hazard when fish were absent. Efforts to prevent the establishment of a fish population in the Lone Tree Mine pit lake should be clearly addressed.

<u>CHAPTER 3. AFFECTED ENVIRONMENT FOR PROPOSED ACTION AND ALTERNATIVES</u>

8P <u>Water Resources, Surface Water Quantity. Pages 3-24 to 3-34.</u> The DEIS reports a net evaporation rate of 3 to 3.5 feet per year for the project area. Information should be provided as to how this rate was determined. Morgan (1982) reported evaporative water losses (evapotranspiration plus surface evaporation) of 54 inches per year (4.5 feet per year) for shallow marshes in Lahontan Valley. Langan et al. (1965) reported an average evaporative water loss from open water in Rye Patch Reservoir of 72 inches per year (6 feet per year). Therefore, the net evaporation rate may be higher than that reported. If this is true, the final EIS should report how the changes will affect surface water quality modeling results and anticipated pit lake water losses presented in Chapter 4.

**RESPONSE 8M**

Mine facilities, including the tailings impoundment, are designed for reclamation to not hold water with stormwater diverted around them. Therefore, leaching of chemical constituents is not expected to occur. Testing and analysis of the material will be conducted as described on page 2-44 of the DEIS under the section "Tailings Impoundment Facility". Test results would be used to verify that the leaching characteristics of the tailings have not changed.

**RESPONSE 8N**

The goal of 100 percent plant cover is consistent with BLM standards for revegetation. See Response 7O to the Sierra Club letter in this FEIS for additional information.

**RESPONSE 8O**

Efforts to prevent establishment of a fish population in the pit lake will be developed during the closure plan. An ecological risk assessment completed by ENSR (1996) for the Lone Tree Mine shows that fish would not survive in the pit lake (see Appendix E in this FEIS for a summary of the risk assessment).

**RESPONSE 8P**

As stated in the DEIS (page 3-27) the evaporation rate of approximately 3 to 3.5 feet/year is <u>net</u> evaporation from a surface water body, that is, total evaporation (3.5 to 4.0 feet/year) minus precipitation. This evaporation rate was obtained from Houghton et al. (1975). Average annual precipitation in the Lone Tree Mine area is 6 to 8 inches (DEIS page 3-27). The BLM believes that the net evaporation rate of 3 to 3.5 feet/year specified in the DEIS is reasonable. If rates are actually higher, this would affect the predicted water losses from the cooling pond and pit lake.

The predicted evaporation maximum evaporation rate of 972 acre-feet per year (713 gpm or 1.6 cfs) from the final Lone Tree Mine pit lake is an error (pages 4-36 and 4-41 of the DEIS). The maximum evaporation rate should be **840 acre-feet per year (520 gpm or 1.2 cfs)** (see the revised DEIS Chapter 4 Water Resources section in the Errata section in Chapter 3 of this FEIS).

8Q Water Resources, Table 3-10, Page 3-37. The table provides information on water quality criteria and standards for Nevada. The Service recommends that water quality standards for antimony, molybdenum, and sulfide be added to the table. This is especially important for antimony, which is later identified as a trace element of concern in the pit lake. The standards in the table for the following parameters appear to be in error, with the corrected value (mg/L) in parentheses: Arsenic - aquatic life 1 hour (0.342), 96-hour (0.180), both for arsenic III; boron - aquatic life standards have been dropped; cadmium - municipal or domestic supply (0.010); chromium - municipal or domestic supply (0.050); chromium - aquatic life 1 hour

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(0.015), 96-hour (0.010), both for chromium VI; mercury - aquatic life, 1 hour (0.002). Also, there are standards for chromium III that are based on hardness. All of these standards should be carefully checked with the latest information from the Nevada Division of Environmental Protection.

**RESPONSE 8Q**

Table 3-10 from the DEIS (page 3-37) has been revised to include standards for antimony, molybdenum, and sulfide (see the Errata section in Chapter 3 of this FEIS). In addition, all of the standards have been checked with the latest information from NDEP.

8R Water Resources, Surface Water Quality, Pages 3-34 to 3-40. The DEIS provides information at the end of the first paragraph on arsenic concentrations in the Humboldt River upstream and downstream of Rye Patch Reservoir. Data from the downstream segment included sites below irrigation drainage inputs. It would be more appropriate to report a downstream median arsenic value of 0.028 mg/L, that does not include data from sites adversely impacted by irrigation drainage.

**RESPONSE 8R**

Median arsenic concentrations of 0.016 and 0.057 milligrams per liter (mg/L) reported in the DEIS (page 3-38) for the Humboldt River upstream and downstream, respectively, of Rye Patch Reservoir, are based on measurements by the U.S. Geological Survey. Therefore, they represent actual conditions in the river that exist downstream of the Lone Tree Mine discharge, regardless of the source. We do agree that an arsenic concentration of 0.028 mg/L is more representative of Humboldt River water downstream if it were not affected by irrigation drainage.

8S Some corrections from Table 3-10 need to be carried over into Table 3-12, which provides a summary of water quality in the Humboldt River in the vicinity of the Lone Tree Mine. Information on additional parameters (see above) should also be added to this table. For those aquatic life standards dependent upon hardness, a range of values should be provided based on the range of hardness values for the Humboldt River for the list of sites reported.

**RESPONSE 8S**

Table 3-12 from the DEIS (page 3-39) has been revised to include the same changes that were made to revised Table 3-10 (see the Errata section in Chapter 3 of this FEIS). In addition, the hardness-dependent standards on revised Table 3-12 have been calculated using an average hardness value of 175 milligrams per liter for the Humboldt River.

8T Water Resources, Ground Water Quality, Pages 3-56 to 3-58. The last sentence of the fourth paragraph indicates that no aquatic life standards were exceeded in the water discharged by the mine. This statement is in error. Table 3-20, a summary of water quality for mine dewatering discharge, reports an iron concentration (1.4 mg/L) in the mine discharge water that exceeds the aquatic life standard of 1.0 mg/L.

**RESPONSE 8T**

You are correct that the iron concentration of 1.4 milligrams per liter measured in the mine discharge water during the 4th quarter of 1994 did exceed the aquatic life standard. The statement on page 3-56 of the DEIS (last sentence of the first full paragraph in the second column) has been revised and is included in the Errata section in Chapter 3 of this FEIS. Table 3-20 from the DEIS (page 3-58) has been revised and is included in the Errata section in Chapter 3 of this FEIS.

8U The number of parameters reported in Table 3-19 (Summary of Ground Water Quality Data in Vicinity of Lone Tree Mine) is too restrictive. A much broader suite of trace elements should be reported. Inclusion of antimony and fluoride in this table are essential because concentrations in pit lake water are expected to exceed drinking water standards (see page 4-37).

**RESPONSE 8U**

Table 3-19 from the DEIS (page 3-57) has been revised to include the paramelers of antimony and fluoride (see the Errata section in Chapter 3 of this FEIS). This table includes those parameters in groundwater that are of primary concern with respect to potential water quality impacts at the Lone Tree Mine.

8V Table 3-20 (Summary of Mine Dewatering Discharge Water Quality) appears to be highly selective in reporting only a small number of constituents in dewatering discharges. A more complete list of constituents, especially trace elements, should be reported if potential effects on fish and wildlife are to be properly evaluated. The 1993 permit requirement for lead was 0.05-mg/L, not 0.2-mg/L as indicated in the table. There also appears to be a typographical error for lead for the fourth quarter of 1994; the "less than" sign is in the wrong location.

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The lead concentrations that are reported are near those causing adverse effects to biota. For example, reproduction of *Daphnia* was impaired by 10 percent when exposed to 0.001-mg/L lead (Environmental Protection Agency 1985).

8W Water Resources, Hydrologic Monitoring Program, Page 3-59. The data presented in Table 3-20 indicate that water quality is variable. Mechanisms causing variations should be discussed. The potential for other constituents of concern (i.e., metals, trace elements, chemical compounds), that have not been monitored, to vary temporally should also be discussed. Information should also presented on the potential for these constituents to exceed Nevada water quality standards or levels which may adversely affect aquatic life. The ability of the water treatment plant to remove constituents of concern should be discussed. Contingency plans should be identified in the event that effluent quality does not meet standards for discharge to surface waters.

8X Discharge of dewatering effluent will increase loads of persistent contaminants (trace elements) in the aquatic system of the terminal Humboldt River Basin. The DEIS should identify the expected ranges of total loads for potentially toxic constituents discharged annually and over the life of the mine. These estimates should be compared with historic loads of these materials in the Humboldt River near the point of dewatering effluent discharge.

**RESPONSE 8V**

Table 3-20 in the DEIS (page 3-58) reports all of the parameters that are required and analyzed for the NPDES permit; no other parameters are measured (see revised Table 3-20 in the Errata section in Chapter 3 of this FEIS). The lead value in Table 3-20 of the DEIS for the fourth quarter of 1994 should have been just a single value of 0.002 milligrams per liter (mg/L); therefore, the corrected Table 3-20 has deleted the <.05 value. The current NPDES permit requirement for lead is 0.11 mg/L; this value is now added to revised Table 3-20.

Concentrations of lead reported in Table 3-20 for discharge water range from <0.001 to 0.002 mg/L. Using an average hardness value of 175 mg/L for the Humboldt River, the aquatic life standards (chronic/acute) for lead are 0.002 and 0.083 mg/L.

**RESPONSE 8W**

Quality of Lone Tree Mine discharge water generally has shown little variation over the period of pumping. Minor variations do occur as different water-bearing formations are encountered with the expanding pit and as pumping rates vary from the dewatering wells. The range of water quality concentrations presented on Table 3-20 (see revised table in the Errata section in Chapter 3 of this FEIS) are expected to be representative of discharge water for the life-of-mine.

Water quality data from the dewatering wells and discharge monitoring, to date, have indicated that the primary constituent of concern is arsenic. However, other constituents could exceed discharge standards at any time. Therefore, the basis for monitoring shall be as outlined in the NPDES permit. If any constituents exceed limits specified in the discharge permit, measures would be taken, as directed by NDEP, to correct the situation.

**RESPONSE 8X**

Loading calculations for the Lone Tree Mine discharge water and the Humboldt River have been conducted and are included in Appendix F of this FEIS (see Response 5F to the U.S. Environmental Protection Agency letter in this FEIS).

8Y Aquatic Habitat and Fisheries. Pages 3-81 to 3-82. The last paragraph of this section deals with macroinvertebrate sampling along the Humboldt River in 1995. Data from this study should be presented in the document. With regard to data interpretation, it is less relevant that some invertebrates which are tolerant of higher sedimentation and nutrient pollution occur along the entire stretch of the Humboldt River from Battle Mountain to Winnemucca than it is to compare relative frequencies of these groups (tolerant vs. intolerant, for instance) between sites. The data analysis should include information on water quality at collection sites along the Humboldt River upstream and downstream of the confluence with Iron Point Relief Canal. We also recommend that data collected in Humboldt County by Mr. Robin Gray, on the assemblage and abundance of blackfly larvae (family Simuliidae) at sites from Battle Mountain downstream to the Humboldt-Pershing County line, be analyzed and the results be included in the document. The period covered by this data set makes it highly valuable in assessing natural variation in the community assemblage of this family of macroinvertebrates. The analysis should include a comparison of the Simuliid assemblages before Lone Tree Mine began its dewatering operations in 1991 to current conditions, to gauge if this community's tolerance or diversity levels have changed as a result of the dewatering discharge.

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8Z Threatened, Endangered, and Candidate Species. Pages 3-85 to 3-87. The DEIS incorrectly states that the bald eagle is endangered. The status of this species was recently changed to "threatened," not endangered. Additionally, please note the correct spelling of oryctes (not orocythes) here and throughout the document.

8AA The DEIS indicates that pygmy rabbits often use habitat near springs. Adverse impacts to springs resulting from current as well as future dewatering operations may be affecting pygmy rabbit populations in this area (also see comments on Chapter 4: Consequences of the Proposed Action and Alternatives, Water Resources, Impacts on Springs and Seeps). Surveys should be conducted to determine if active burrows occur in the study area.

**RESPONSE 8Y**

Data from the macroinvertebrate studies conducted in 1995 are included in Appendix K. These studies looked at relative frequencies of tolerant versus intolerant organisms.

Table 3-12 from the DEIS (page 3-39) has been revised and includes more recent water quality data for the Humboldt River at the Battle Mountain (upstream of mine discharge) and Comus (downstream of mine discharge) gage sites (see the Errata section in Chapter 3 of this FEIS).

**RESPONSE 8Z**

Comment noted. The status of bald eagles has been corrected from "endangered" as listed in the DEIS (pages 3-85 and 4-51) to "threatened". In addition, the incorrect spelling of "orocythes" in the DEIS (page 3-87) has been corrected to "oryctes". These corrections are included in the Errata section in Chapter 3 of this FEIS.

**RESPONSE 8AA**

Pygmy rabbits are not obligately associated with springs. They also occur in sagebrush habitats without springs nearby. The possible association of pygmy rabbits with springs does not appear to be researched or understood. It is not predicted based on the groundwater flow model that springs other than those that have dried up under existing conditions (i.e., Treaty Hill, Brooks, Stonehouse, Planck, and Hot Pot springs) would be dewatered by the Lone Tree Mine. The Proposed Action, however, would extend the period of time that affected springs remain dry. Therefore, the Proposed Action is not expected to affect additional springs or pygmy rabbits if they are associated with springs.

The Proposed Action is not expected to pose impacts or risk to pygmy rabbits or their habitat. Expansion of mine facilities is primarily in salt-desert shrub habitat; whereas, pygmy rabbit habitat is in tall stands of big sagebrush. Marginal habitat for pygmy rabbit (spiny hopsage/big sagebrush community) is present along some ephemeral drainages in the area that would be disturbed by the Lone Tree Mine. Field reconnaissance studies of the area to be disturbed were conducted by biologists working as consultants to BLM. No pygmy rabbits or potential burrows were found. Searching the entire project area for pygmy rabbits does not seem justified if impacts to pygmy rabbits are not expected, even if they are present in portions of the project area that would not be disturbed.

8BB The California floater (*Anodonta californiensis*), a category 2 candidate species, was inadvertently not included in the species list the Service provided you (file number: 1-5-94-SP-126). Although information on the current distribution of the floater is lacking, historic records showed this mussel occupied the Humboldt River upstream and downstream from Iron Point Relief Canal. We recommend surveys be conducted to determine whether the California floater occurs in the area and recommend a discussion of potential impacts to this species be included in the final EIS.

CHAPTER 4. CONSEQUENCES OF THE PROPOSED ACTION AND ALTERNATIVES

8CC Water Resources, Summary, Page 4-7. The water temperature standard for the Humboldt River is mentioned at the end of the fourth paragraph. Information on the current standard should be provided.

8DD Water Resources, Direct and Indirect Impacts, Proposed Action, Ground Water Flow Model, Pages 4-8 to 4-11. In the second paragraph, the DEIS mentions that a proprietary computer program was used to predict or model ground water flow. The Service questions the use of proprietary computer programs for modeling because agencies and the public are unable to determine if the program was properly developed. We would prefer that a recognized model, perhaps one developed by the U.S. Geological Survey (if available), be used instead. If this is not possible, BLM should "certify" that the proprietary program is appropriate. Also, base data and parameter limits used in the model should be made available.

Water Resources, Direct and Indirect Impacts, Proposed Action, Impacts on Springs and Seeps, Pages 4-26 to 4-29. The DEIS indicates that current dewatering operations may contribute to desiccation of at least three springs near the projected cone of depression at year 2010 (Table 4-3). The Service suggests that more springs than this have been impacted from

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**RESPONSE 8BB**

Field surveys for California floater were conducted in the Humboldt River near Carlin as part of the impact assessment of Newmont's Gold Quarry Mine (South Operations Area). Historic records indicate that the Humboldt River was once inhabited by this mussel. The surveys did not find California floater in the mainstem Humboldt River although remnants of very old California floater shells were found. A population of California floater was found in the North Fork Humboldt River and more recently in the Boulder Creek drainage northwest of Carlin. Because of extreme alteration of the Humboldt River from channelization activities and dewatering of the river from irrigation diversions, habitat downstream from the project area probably can no longer sustain California floater (the Humboldt River in the vicinity of the Lone Tree Mine project site commonly ceases to flow in dry summer periods, but retains water in deeper channel segments). Due to severe alteration of habitat and reductions in water quality over the last century, it is unlikely that California floaters are extant in the Humboldt River.

If California floaters are present in the Humboldt River, it is not possible to accurately predict if increased mine water discharge would affect this species. Little is known about their responses to flow regimes, life history, or habitat limitations. Reductions in flow in the Humboldt River after cessation of mine dewatering may result in stress or mortality to California floaters, if present. Although it is unlikely that California floaters remain extant in the lower Humboldt River, a survey will be conducted when water levels decrease to determine if the species is present.

**RESPONSE 8CC**

Water temperature standards for Nevada have not yet been changed by NDEP; the 2°C standard mentioned in the DEIS is still applicable.

**RESPONSE 8DD**

See Response 7X to the Sierra Club letter in this FEIS; also see Appendix H in this FEIS for an expanded summary of the groundwater flow model conducted by HCI (1994a). The complete report by HCI (1994a), *"Hydrogeologic Framework and Numerical Ground-Water Flow Modeling of Region Surrounding Santa Fe Pacific Gold Corporation's Lone Tree Mine, Humboldt County, Nevada"*, along with *Addendum I* (HCI 1995b) and *"Predicted Rate and Nature of Infilling of Lone Tree Pit Lake"* (HCI 1996b) contain a summary of the data and parameter limits used in the model; these reports are available for review at the BLM Winnemucca District office.

current dewatering operations and future operations under the Proposed Action could impact several other springs. For instance, although Stonehouse and Planck Springs ceased flowing before current operations began in 1991, no indication of the cyclicity in previous flow rates of these springs has been provided. These springs, like others in the area, may be ephemeral. The number of years that elapse before these springs flow again may be extended due to the lowered ground water level. The document states that four other springs (Sulphur, Mud, Ames, and Hot Pot) lie near the predicted cone of depression at year 2036 under the Proposed Action scenario. 8EE We are particularly concerned with whether these and other springs in the area support endemic springsnails which could be directly impacted by current and future dewatering operations. We suggest that appropriate surveys of impacted and potentially impacted springs be conducted to determine if endemic snails occupy these areas. We recommend that if endemic springsnails are found during surveys, measures be developed to prevent desiccation of these springs.

8FF <u>Water Resources, Direct and Indirect Impacts, Proposed Action, Impacts on Streamflow, Pages 4-29 to 4-32.</u> The DEIS shows only one cross-section of the Humboldt River, with mine discharge water added to mean monthly flows in the river. This limited information is insufficient to ascertain whether the stream channel can hold natural streamflow plus predicted dewatering discharge. Of more use would be to model scenarios with more cross-sections and to include a range of peak discharges rather than one mean value because annual flows in the river are highly variable.

**RESPONSE 8EE**

As stated in the DEIS (pages 4-26 through 4-29), five springs in and near the predicted groundwater cone of depression have ceased flowing: Treaty Hill, Brooks, Stonehouse, Planck, and Hot Pot springs. Three other springs -- Sulphur, Ames, and Mud -- are located near the predicted cone of depression; however, water sources for these springs are associated with the Edna Mountains fault system (Sulphur Spring) and perched water from the Battle Mountains (Ames and Mud springs). Therefore, it is not expected that dewatering at the Lone Tree Mine would affect these three springs. Other springs shown on Figure 4-8 of the DEIS (page 4-27) farther from the predicted cone of depression are associated primarily with higher elevations in the surrounding mountains; these springs likely are perched and would not be affected by mine dewatering.

A study conducted by a snail expert in April 1996 did not find springsnails at eight spring/seep sites in the vicinity of the Lone Tree Mine: Ames, Mud, Hot Pot, Sulphur, Treaty Hill, Brooks, unnamed spring on north slope of Battle Mountain, and unnamed seeps on Cumberland Creek. A copy of the survey report is included in Appendix M in this FEIS.

**RESPONSE 8FF**

The Humboldt River cross section used in the DEIS (Figure 4-9, page 4-33) is meant to be typical and not representative of all possible configurations of the river. The figure does, however, include a wide range of flow conditions that occur in the river, ranging from average October baseflow (28 cfs) to the maximum average monthly flow (834 cfs). The primary purpose of this figure is to show relative changes in river stage or level when the maximum predicted mine discharge rate of 167 cfs is added to a range of natural flows in the river. It is possible that when natural flow in the river is near bankfull conditions, the extra mine discharge flow could contribute to some flooding conditions; however, the additional increase in river level at these naturally high flow conditions would be difficult to measure.

A new figure has been prepared to illustrate the effects on surface water stage in the Humboldt River at a typical multi-channel river section for various discharge rates (see Figure Appendix N-1 in Appendix N in this FEIS). Under a multi-channel river configuration, the increase in stream stage resulting from addition of the predicted mine discharge would be less pronounced than that occurring at a single channel reach, such as that shown in Figure 4-9 of the DEIS. During 1984, an instantaneous peak discharge rate of 9,900 cfs was measured in the Humboldt River at the Comus gage. If a flood event of that magnitude were to occur during the operational period of the Lone Tree Mine, the maximum predicted mine discharge rate of 167 cfs would constitute less than 2 percent of the total flow in the Humboldt River, and the resultant increase in river stage would be immeasurable.

8GG Water Resources, Direct and Indirect Impacts, Proposed Action, Stream and River Channel Stability, Pages 4-32 to 4-35. The DEIS states that the Proposed Action is not expected to significantly affect channel stability. However, no information is provided to determine whether increased erosion has occurred along the Humboldt River due to current dewatering operations. Therefore, it is difficult to predict whether the river channel can potentially sustain prolonged discharge as is proposed under the Proposed Action. Silt and fine sand are highly erodible substrates and are susceptible to becoming suspended in high flow conditions due to their small sizes.

8HH Information on total suspended solids (TSS) concentrations in the Humboldt River in the study area, before dewatering from the mine, is provided in the third paragraph. However, there is no information on TSS concentrations of the water coming from Iron Point Relief Canal. Furthermore, the TSS concentrations listed for the Humboldt River are of little value in determining the trend in suspended solids that is occurring in this watershed because the only data reported were collected in 1975 (Table 3-12). Additional information is needed to

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determine whether aquatic biota in the Humboldt River are potentially being affected by TSS levels under current operations and to predict whether it may be an issue under the Proposed Action.

8II Water Resources, Direct and Indirect Impacts, Proposed Action, Impacts on Surface Water Quality, Pages 4-35 to 4-36. The second paragraph indicated that a water treatment plant is being built to reduce arsenic levels to acceptable levels. Acceptable levels must be defined in the final EIS.

### RESPONSE 8GG

See Response 5G to the U.S. Environmental Protection Agency letter in this FEIS for information regarding potential erosion impacts to the Humboldt River.

### RESPONSE 8HH

The total suspended solids (TSS) concentration in a sample collected from the Iron Point Relief Canal during December 1995 was 69.4 milligrams per liter (mg/L). From mid-1994 through mid-1995, TSS concentrations in mine dewatering discharge water at the end-of-pipe ranged from <0.1 to 19 mg/l (see revise Table 3-20 in the Errata section in this FEIS). Table 3-12 from the DEIS has been updated with more recent water quality data for the Humboldt River (see the Errata section in Chapter 3 of this FEIS for revised Table 3-12). At the Battle Mountain gage, TSS concentrations in the Humboldt River ranged from 9 to 2,776 mg/L during the period 1990 through 1995. TSS in the Humboldt River at the Comus gage ranged from 7 to 550 mg/L during the same time period. Water quality data provided by NDEP indicate that TSS concentrations in the Humboldt River at the Comus gage have ranged from 7 to 4,296 mg/L for the period of record (1975 through 1995).

In general, high TSS concentrations correlate with high flows associated with snowmelt and/or high precipitation events. As discussed on page 4-32 of the DEIS, TSS concentrations in the Humboldt River are not expected to increase as a result of the Proposed Action because discharge water entering the river from the existing canal system would have low sediment concentrations. Some additional sediment would be picked up in the river until an equilibrium concentration is attained that is similar to ambient concentrations upstream of the Herrin Slough confluence. As a result, aquatic biota in the river are not expected to be impacted by changes in TSS from the mine water discharge.

### RESPONSE 8II

The acceptable arsenic treatment level for the discharge water is the NPDES permit standard of 0.05 milligrams per liter (see revised Table 3-20 the Errata section of this FEIS).

8JJ

The analysis that has been conducted in this section is inadequate. Items that must be specifically addressed are:

1. Deposition of trace elements from water to sediments is expected in the cooling pond. Sediment in the lakes of Stillwater and Fernley Wildlife Management Areas (WMA) accumulates trace elements from the overlying water column (Lico 1992). Therefore, one should expect the same here. These ponds will likely develop aquatic communities. The plants and invertebrates in the ponds will likely bioaccumulate and biomagnify trace elements which will then become available to migratory birds that will be attracted to the ponds. Temperature in the ponds will make them attractive to migratory birds, especially waterfowl, throughout the year, thus providing for extended exposure to these contaminants.

**RESPONSE 8JJ**

The quantity of trace elements which can be adsorbed by sediments is determined by the cation-exchange equilibria, but is limited by the number of potential bonding sites. Thus, sediment is only able to hold onto a limited quantity of ions. Once the sediment has become saturated with respect the chemistry of the pond water, no more adsorption will occur. Pond water would be expected to saturate the underlying sediment to the depth at which the water may migrate; however, the sediment would likely not be significantly enriched in trace elements because of this. The adsorption of some ions or trace elements would also necessarily release other ions to the water.

The comparison with the Stillwater and Fernley Wildlife Management Areas is not appropriate due to the different upstream conditions of these sites. Some deposition of trace elements may occur in the drainage ditch and cooling ponds associated with the Lone Tree Mine due to changing geochemical conditions of the water as it equilibrates to surface temperatures and conditions.

Typically, groundwater contains higher concentrations of carbonate and bicarbonate than surface water. This increases the partial pressure of carbon dioxide and causes increased concentrations of carbonate and bicarbonate. Groundwater withdrawn by the Lone Tree Mine will equilibrate to surface conditions and the concentration of these two anions will decrease. These two compounds are also important in controlling the alkalinity and pH of water. Groundwater from the mine will also be in contact with higher concentrations of oxygen from the atmosphere, which will change the equilibria of ions and trace elements in the water.

Possible results of these geochemical reactions are interrelated and intertwined. Dissolution of carbonate and bicarbonate will increase the pH of water. Cooling of the water will slightly decrease the solubility of calcium carbonate, sodium chloride, sodium sulfate and sodium hydroxide. Cooling will also increase the solubility of other minerals, including calcium hydroxide, calcium sulfate, arsenic sulfide, and arsenic trioxide. Oxidation of the water may result in insoluble precipitates of iron or manganese forming along the channel or in the ponds; however, concentrations of iron and manganese in the discharge water are low. Arsenic has been reported to either adsorb to these precipitates, coprecipitate with them, or by a combination with sulfate be deposited in the bottom mud of water bodies (Hem, USGS Water Supply Paper 2254). A water treatment plant at the Lone Tree Mine will reduce concentrations of arsenic to within the discharge limits prior to the water entering the cooling ponds. Accumulation of trace metals could occur at the cooling ponds; however, the relatively short period of time the ponds will be operational (approximately 12 years) and the low concentrations of trace elements in the water limit the amount of accumulation in sediments and associated bioconcentration effects.

8KK

2. The impact of a flood from the Humboldt River washing out these cooling ponds, with their associated contaminated sediments, should be evaluated. Long stretches of the river, possibly including terminal wetlands, could be adversely impacted.

8LL

3. Information on all trace elements present, not just a short list, should be considered in evaluating impacts to water quality. Quality of water from dewatering discharges should be compared with existing water quality in the Humboldt River and not just existing water quality standards. This is necessary to determine if concentrations and loading in the river will increase. This evaluation must consider impacts in terminal wetlands in the Humboldt Wildlife Management Area, as well as wetlands in intermediate reaches of the river. Several trace elements are already having adverse effects on biota in the Humboldt WMA (Seiler et al. 1993). Increased loading of trace elements from mine dewatering could exacerbate current problems in these terminal wetlands.

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Transport of trace elements in aquatic systems can occur in several phases. First, elements can be transported in the dissolved state. Radtke et al. (1988) found little or no change in concentrations of dissolved arsenic and selenium in Colorado River water between Davis Dam and Imperial Dam, a distance of approximately 235 miles. In the reach of river studied, water was withdrawn for irrigation, but little was returned in the form of drainwater or agricultural return flows. Selenium source areas, for water reaching Imperial Valley, occur upstream of Davis Dam on the Colorado River, a distance exceeding 300 miles (Radtke et al. 1988).

Sediment, particulate matter, and biological materials also provide important transport pathways for trace elements in aquatic systems. Mercury introduced into the Carson River near the Virginia Mountain Range, Nevada, has become widely distributed throughout the lower Carson River Basin (Cooper et al. 1985; Hoffman et al. 1990; Hallock and Hallock 1993). Mercury contamination extends through approximately 100 miles of river channel and terminal wetlands. Sediment, particulate matter, and biological material have been identified as important transport vehicles for the mercury (Cooper et al. 1985; Hallock and Hallock 1993). Particulate and biological material have also been identified as transport vehicles for other trace elements (Moore et al. 1990; Moore et al. 1991; Hallock and Hallock 1993).

Setmire et al. (1993) provided convincing evidence that dissolved solids and certain trace elements can pass through agricultural systems similar to those in the lower Humboldt River basin. In this study, these constituents were actually concentrated in agricultural drainwater. In this event, adverse effects of dewatering effluent may be further exacerbated.

8MM

We agree that the biogeochemistry of trace elements is complex and movement of trace elements in aquatic systems is governed by many factors. However, we recommend against dismissing a detailed analysis because of complexities and difficulties in prediction. We are willing to provide additional references and information on this issue if needed.

**RESPONSE 8KK**

See Response 8JJ above regarding sediments in the cooling pond. In the unlikely event that a flood (100-year event) would erode the cooling pond berms and sediments from the pond washed out, the sediments are not expected to contain high levels of trace elements. The cooling pond berms should remain stable if floodwater from the river reaches the cooling pond because the flow velocities in the flooded river in this area are expected to be relatively low. The 100-year floodplain in the vicinity of the Lone Tree Mine is shown on Figure 3-10 of the DEIS. The cooling ponds have embankment heights of 9 to 14 feet. These berms likely would not be exceeded by flood water and should not erode completely because of low water velocity at the far extent of the 100-year floodplain where the cooling pond system is located.

**RESPONSE 8LL**

See Response 5F to the U.S. Environmental Protection Agency letter and Appendix F in this FEIS for information about loading in the Humboldt River. Some additional chemical constituents have been added to Table 3-20 (Summary of Mine Dewatering Discharge Water Quality) and Table 3-12 (Summary of Humboldt River Water Quality Data in Vicinity of Lone Tree Mine) has been updated with more recent quality data for the Humboldt River (see the Errata section in Chapter 3 of this FEIS for revised Tables 3-12 and 3-20). A new column has been added to revised Table 3-20 that includes water quality standards for the Comus gage control point on the Humboldt River (replaces column for drinking water standards). Table 3-11 in the DEIS (page 3-38) also has been revised to update the Comus gage control point standards and add the parameter of sulfate (see Errata section in Chapter 3 in this FEIS).

**RESPONSE 8MM**

See Responses 7F and 7K to the Sierra Club letter in this FEIS for information about the adequacy of the cumulative effects analysis contained in the DEIS and loading effects on Rye Patch Reservoir and the Humboldt Sink.

8NN <u>Water Resources, Direct and Indirect Impacts, Proposed Action, Impacts from Mine Pit Water Recovery. Pages 4-36 to 4-38</u>: The second paragraph of this section indicates that a study was commissioned to evaluate chemistry of the pit lake associated with the Proposed Action. The study used existing chemical and hydrogeologic data in conjunction with laboratory tests and computer models. Background data used in evaluating chemistry of the pit lake and the computer models should be made available so that the public can evaluate the conclusions provided in the DEIS. Water quality of the pit lake should be compared to aquatic life standards as well as drinking water standards because it is likely that an aquatic community will become established. Information should be provided on impacts of subsurface flow in the alluvial aquifer, from the pit lake, to water quality in the Humboldt River.

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8OO The DEIS reports that, at final elevation, a maximum of 972 acre-feet per year will be lost through evaporation from the pit lake. This loss is calculated on an evaporation rate of 3 feet per year. The evaporation rate may be higher in the project area (see comments above). Because the final surface elevation of the pit lake is very near the ground surface, effects from the pit walls to reduce evaporation may also be minimized.

8PP No mitigation for evaporative water loss from the pit lake was noted in the DEIS. The Service recommends that water rights in this amount (972 acre feet per year) be acquired from private interests. These rights could then be donated to the NDOW for purposes of providing habitat for wetlands and wetland-dependent species in the Humboldt River basin.

**RESPONSE 8NN**

Information pertaining to the pit lake geochemistry prediction is contained in the reports, *"Assessment of Pit-Lake Chemogenesis and Waste-Rock Characterization at the Lone Tree Mine, Nevada"* (PTI 1995) and *"Revised Prediction of Water Quality in the Lone Tree Mine Pit Lake"* (PTI 1996); these reports are available for review at the BLM Winnemucca District office. A summary of the PTI pit lake study is included in Appendix D in this FEIS. Also see Response 7V to the Sierra Club letter in this FEIS.

Table 4-5 in the DEIS (page 4-38) has been revised to include aquatic life standards; some of the water quality data have also changed as a result of refined pit lake predictions since the DEIS was prepared (see Errata section in Chapter 3 of this FEIS for revised Table 4-5).

Information about potential water quality impacts to groundwater surrounding the pit lake and possible effects on the Humboldt River are discussed in Response 7W to the Sierra Club letter in this FEIS. Also see Appendix D in this FEIS for a summary of the model setup and results.

**RESPONSE 8OO**

See Response 8P above for an explanation of the selection of evaporation rates in the DEIS. As stated on page 4-36 of the DEIS (end of second column), the net evaporation rate of 3.0 feet per year used for the pit lake is less than the 3.5 feet per year evaporation rate used for the cooling pond because of some evaporation reduction from the pit walls. We agree that the final pit lake surface would be relatively close to the ground surface (approximately 75 feet); therefore, the ultimate maximum evaporation rate from the final pit lake may be slightly higher than 3.0 feet per year, but less than 3.5 feet per year. See the revised Chapter 4 Water Resources section in the Errata section of the FEIS.

**RESPONSE 8PP**

Comment noted.

8QQ Table 4-5 provides data on predicted quality of water in the pit lake. Confidence intervals should be reported for the predicted concentrations. Data on additional constituents (i.e., boron, mercury, molybdenum, and vanadium) should also be reported.

8RR The DEIS reports that the predicted final elevation of the surface of the pit lake is estimated at 4460 feet above mean sea level. This elevation appears very close to the elevation of the ground surface on the northern end of the pit. The possibility of degraded pit water flowing uncontrolled from the pit lake should be discussed. The document should review methods used to determine the final pit lake elevation and the certainty of this estimation. This discussion should include several factors such as pre-mining ground water elevation at various points around the pit, ground water flow direction, direction of inflow to the pit, and temporal ground water elevation fluctuation.

8SS Information should be presented on the potential for surficial alluvium around the perimeter of the pit lake to be eroded and provide habitat for aquatic, emergent, and riparian vegetation, and vertebrate and invertebrate species. Potential effects of trace elements to plant and animal species should be evaluated. This evaluation should include both acute and chronic effects to various life history stages of organisms and the potential for chemical elements to bioaccumulate and biomagnify in the food chain. If risk to the environment is possible, mitigative measures should be identified.

8TT <u>Water Resources. Potential Mitigation and Monitoring Measures. Pages 4-40 to 4-41.</u> The DEIS mentions the current hydrologic monitoring program for the mine, indicates that springs and seeps would continue to be monitored, and that minor impacts to the Humboldt River are expected. However, no information is provided with regard to what can or will be done to

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correct water quality problems in the pit lake if they should develop. Monitoring and periodic evaluation are not enough. Mitigation strategies should be developed and described in the final document.

**RESPONSE 8QQ**

Table 4-5 in the DEIS (page 4-38) has been revised to include boron and mercury (molybdenum and vanadium were not included in the PTI (1995 and 1996) pit lake predictions because they were not considered constituents of concern). Some of the water quality data have also changed as a result of refined pit lake predictions since the DEIS was prepared (see Errata section in Chapter 3 of this FEIS for revised Table 4-5; see Appendix D in this FEIS for a summary of the PTI pit lake study).

**RESPONSE 8RR**

The predicted final elevation of the pit lake specified in the DEIS (pages 4-12 and 4-36) of approximately 4,460 feet is based on the average premining water table elevation in the area of the Lone Tree Mine pit. Based on revised modeling, however, the new predicted steady-state pit lake elevation is 4,425 feet above mean sea level (see the revised Chapter 4 Water Resources section in the Errata section of this FEIS). There were no surface expressions of groundwater flow (i.e., springs and seeps) within the footprint of the mine pit prior to initiation of mining. Therefore, groundwater would not be expected to flow out of the pit at any time from the pit lake.

**RESPONSE 8SS**

See Response 5B to the U.S. Environmental Protection Agency letter in this FEIS for information about potential effects of trace elements to plant and animal species in the pit lake. Surface alluvium around the perimeter of the pit lake could erode and provide habitat; however, aquatic organisms likely would not colonize in the final pit lake. Also see Appendix E for a summary of the ecological risk assessment (ENSR 1996) for the Lone Tree pit lake.

**RESPONSE 8TT**

Water quality problems that could develop with the pit lake would be dealt with by NDEP; results of predictive pit lake studies (PTI 1995 and 1996) and an ecological risk assessment for the pit lake (ENSR 1996) show that the Lone Tree Mine pit lake should not pose a problem to potential receptors or surrounding water resources (see Appendix E for a summary of the ecological risk assessment).

8UU Soils, Direct and Indirect Impacts, Growth Medium Handling, Page 4-43. The DEIS indicates that soil in the cooling ponds area will be used as growth media for reclamation purposes. Contamination of sediments in the cooling ponds might cause problems in reclamation and revegetation. This issue should be addressed in the final EIS.

8VV Vegetation, Direct and Indirect Impacts, Proposed Action, Pages 4-45 and 4-47. The DEIS describes effects of dewatering on vegetation at springs and seeps. The Service is concerned with potential adverse effects to springs near the predicted cone of depression. Although both Hot Pot and Brooks Springs are not within the predicted cone of depression (Figure 4-8), their hydrology may be linked to ground water. We recommend that elucidation of the rationale behind why these springs would not be affected be provided. Moreover, even though Mud and Ames Springs are reported as "mud with grass" or as "muddy" (Table 3-14), these and other springs could support, among other organisms, endemic springsnails.

8WW Reclamation of disturbed areas should have as its goal the restoration of natural ecosystems. Revegetation of disturbed areas should be done using native plants indigenous to the area.

8XX The DEIS generally indicates that wetland and non-wetland riparian vegetation associated with the Humboldt River will benefit from the Proposed Action. We do not concur with the argument that augmented flows will benefit riparian vegetation as described. Substantial information exists on adverse effects of flow augmentations to survival and growth of some riparian vegetation through suffocation of roots which reduced growth rates in adult willow trees (Dionigi et al. 1985; Stromberg and Patten 1992), increased mortality of juvenile willows (Stromberg and Patten 1992), and decreased survival of seeds (Strahan 1987). These effects could increase erosion along the Humboldt River through loss of root stabilization and subsequently impact the aquatic ecosystem as well as reduce available habitat for birds and wildlife which associate with riparian vegetation. We recommend that additional mitigation measures be developed for minimizing these potential impacts to the riparian community along the Humboldt River downstream of Iron Point Relief Canal.

**RESPONSE 8UU**

See Responses 8A and 8JJ above for information regarding potential contamination of cooling pond sediments.

**RESPONSE 8VV**

See Response 8EE above for a discussion of impacts to springs and information relative to a springsnail survey conducted in the vicinity of the Lone Tree Mine. Both Brooks Spring and Hot Pot Springs have become dry within the last 5 years, probably due to a combination of mine dewatering and below-average precipitation (see page 4-26, second column of the DEIS). These two springs likely have a structural connection to the Wayne Zone where most of the Lone Tree Mine dewatering is occurring. No endemic springsnails were found at Mud or Ames springs during the survey (see Appendix M in this FEIS for results of the springsnail survey).

**RESPONSE 8WW**

See Response 5Y to the U.S. Environmental Protection Agency letter and Response 7O to the Sierra Club letter in this FEIS for a statement about reclamation and revegetation using native plants.

**RESPONSE 8XX**

Riparian systems are naturally dynamic. The riparian zone is continually modified by varying flow regimes, sediment deposition, bank scouring, and vegetative succession. Between 1982 and 1983, flows in the Humboldt River fluctuated by almost 10,000 cfs. Over a 12-year period, average annual flow ranged from 2,022 cfs in 1984 to 50 cfs in 1992. Large variations in flow such as these are a major factor affecting regeneration and ecological succession of riparian vegetation (Niering 1987).

Sustained increases in streamflow can also affect riparian vegetation (Henszey et al. 1988). Impacts to riparian areas along the Humboldt River resulting from mine pit dewatering activities could affect riparian communities at high flow and through increased sustained flow.

**RESPONSE 8XX (continued)**

The Proposed Action would increase flows below the confluence of the Herrin Slough and the Humboldt River an average of 123 cfs and attain a maximum of 167 cfs during the final two years of mining. The maximum average monthly flow in the Humboldt River is 834 cfs; at this volume, dewatering discharge of 167 cfs would contribute an additional 20 percent. This represents an increase in river depth of approximately 0.5 feet at a typical river cross section (see Figure 4-9, page 4-33 in the DEIS). During periods of extremely high flow, such as in May of 1984 when maximum mean flow was 6,227 cfs, the addition of 167 cfs would increase streamflow by about 3 percent. Flooding would affect the Humboldt River channel morphology and riparian vegetation regardless of the addition of excess mine water. For example, sections of the Humboldt River which lacked extensive willow cover were damaged during flooding in 1983 and 1984 prior to dewatering by the mine (Bradley 1985).

Channel banks in the Humboldt River immediately below the confluence of Herrin Slough and the Humboldt River are well vegetated with willows (Neel 1985). Although some riparian species may be drowned or buried during flooding, *Salix exigua* (sandbar willow), the dominant willow along the river would resprout and colonize new beaches and sandbars following the disturbance (Stevens and Waring 1985). Other riparian vegetation would also grow back once flood waters subsided.

Under the Proposed Action, flow in the Humboldt River would continuously be augmented by mine dewatering (123 to 167 cfs) with an additional water depth of 1 to 1.5 feet over current average annual flow (324 cfs) in the river. Mine dewatering would sustain flows in the Humboldt River below Herrin Slough during periods when no water is present due to low precipitation, high evapotranspiration, and agricultural irrigation.

Augmented flow would have positive and negative effects on riparian vegetation within the Humboldt River floodplain. The water table in the riparian zone would be elevated through increased flow and capillary action in the soil. Greater water availability would generally favor hydrophytic species and damage more xerophytic species. Enhanced moderate flows and maintenance of low flow conditions has been beneficial to the establishment and survival of riparian vegetation in Arizona and California (Szaro and DeBanc 1985, Stromberg and Patten 1992). In eastern California, obligate riparian species increased cover and reproduction when minimum flows were returned to a stream from which water was formerly diverted. Sandbar willow had the greatest amount of regeneration. At the same site, facultative and upland species declined due to increased water (Stromberg and Patten 1989). Augmented flow had similar effects on a stream in Wyoming (Henszey et al. 1988).

**RESPONSE 8XX (continued)**

A portion of river bank which is currently exposed for the majority of the year would be inundated (see Figure Appendix N-1 in Appendix N in this FEIS). Augmented flow may damage some hydrophytic vegetation if the rooting zones of plants are completely saturated or inundated. Although sandbar willow generally responds well to increased flow, the plants can be killed by extended periods of complete inundation or saturation (Dionigi et al., 1985).

Willows and other hydrophytic vegetation with rooting zones inundated for long periods of time as a result of augmented flow would become stressed and die. However, hydrophytic vegetation would develop on areas that are currently at higher elevations on the floodplain. Old oxbows, meanders, and wet meadows would become wetter and support plant communities adapted to higher soil-moisture regimes. Sedges and rushes may become more prevalent in hay meadows adjacent to the river. Willows would continue to colonize recent areas of sediment deposition generated as a result of periodic flood cycles.

Under the Proposed Action, mine dewatering would cease in year 2006 and flow in the Humboldt River would decrease due to groundwater recharge in the Lone Tree Mine cone of depression. Decrease in flow could deplete portions of Humboldt River a maximum of 0.45 cfs compared to premining conditions. Loss of river flow to groundwater recharge would continue until approximately year 2033, at which time flow would gradually return to premine conditions. This disruption in flow could affect riparian vegetation. A decrease of 0.45 cfs would cause a portion of the Humboldt River to dry up completely during low flow conditions. Dry sections of the river do occur naturally during dry, low flow conditions. From 1987 to 1992, minimum mean monthly flows in the Humboldt River ranged from 0.1 to 0.2 cfs. However, river flow would also depend upon annual snowmelt, precipitation, and discharge of other mines as a result of dewatering.

If the Humboldt River dries up periodically, as would be expected given drought cycles and losses to recharging the cone of depression, willows and other riparian vegetation would likely die. Decreased water is stressful to riparian species, especially juveniles. Riparian seedlings would not survive under sustained periods of low flow and water stress and would be replaced by facultative or upland shrubs (Smith et al. 1988).

As water availability decreases, riparian community succession would likely proceed towards upland vegetation communities (Boggs and Weaver 1992). Some drought-tolerant species such as greasewood within the riparian zone would persist. Change to a more xerophytic

8YY No information is presented to support the allegation that hydrophytic vegetation is minimally impacted by the current dewatering operation or how abundant it is. The Service recommends that the project proponent develop and report data that show current effects to the hydrophytic

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plant communities in the affected area of dewatering to help identify whether impacts are occurring and whether additional impacts may occur from the Proposed Action.

8ZZ The Service does not concur with the conclusion that no significant impact will occur to riparian vegetation once dewatering operations cease. When dewatering operations cease, much of the surface water in the Humboldt River may be used to recharge the ground water. This may strand riparian vegetation which has relocated to higher bank levels due to increased discharge. We recommend that mitigation measures be developed for this potential impact and that cumulative effects from other mining operations, which will discontinue dewatering operations around the same time, be developed more thoroughly than what is described on page 4-76, paragraph 4.

8AAA <u>Vegetation, Potential Mitigation and Monitoring Measures. Page 4-47.</u> The DEIS indicates that one potential measure to mitigate impacts to vegetation is to prevent livestock grazing on revegetated areas for a minimum of two growing seasons. The Service recommends that determining when reclaimed areas can support reestablishment of livestock grazing be based on an established criteria related to the success of reclamation operations and not on a predetermined period.

8BBB <u>Terrestrial Wildlife, Direct and Indirect Impacts, Proposed Action. Pages 4-48 to 4-49.</u> The DEIS indicates that availability of forage and security cover for wildlife will be lost. The Service is concerned about broader potential impacts from mining operations to birds which use the area. Impacts to nesting habitat of migratory birds would occur in addition to the loss of forage and security cover. Destruction of bird nests and/or their contents may occur if vegetation clearing is conducted during the avian breeding season. Such destruction may be a violation of the Migratory Bird Treaty Act. We recommend that vegetation removal be done outside the avian breeding season or that surveys be conducted prior to removal to ensure that nests are not harmed.

**RESPONSE 8XX (continued)**

community would occur due to less recruitment of juvenile riparian species and the slow die-back of deep-rooted, mature riparian plants. The loss of obligate species, such as sedges and rushes, would occur more quickly.

In conclusion, plant community succession along the Humboldt River below Herrin Slough would become more hydrophytic with the addition of flow from Lone Tree Mine dewatering. Following mining and cessation of dewatering, during periods of drought, loss of streamflow as a result of the groundwater cone-of-depression would reduce hydrophytic vegetation in areal extent to the wettest sites, closest to the active channel. Note that bullet number 6 on page 4-47 of the DEIS addresses monitoring bank stability and associated riparian vegetation.

**RESPONSE 8YY**

There has been no detailed monitoring of potential effects to riparian and hydrophytic vegetation from existing dewatering at the Lone Tree Mine. Reconnaissance-level observations in the project area, however, show no significant effects except for isolated areas around Brooks Spring, Treaty Hill Spring, and Hot Pot Springs. One of the mitigation and monitoring measures included in the DEIS (page 4-47) includes monitoring bank stability and associated riparian vegetation on the Humboldt River, Herrin Slough, and Iron Point Relief Canal.

**RESPONSE 8ZZ**

See Response 8XX above for a discussion of potential impacts to riparian vegetation. Mitigation measures are described in Appendix A in this FEIS.

**RESPONSE 8AAA**

The BLM generally requires a period of 2 years to allow reestablishment of vegetation on reclaimed areas. This amount of time usually is sufficient in this environment to provide for the successful establishment of perennial plants that can support grazing to some extent. Monitoring would be conducted to determine if the vegetation could support grazing use. Mitigation measures for vegetation are described in Appendix A in this FEIS.

**RESPONSE 8BBB**

Comment noted.

8CCC The DEIS indicates that dewatering effluent discharge may inhibit ice formation on water bodies that normally freeze during winter. Changes in the biological community composition and structure resulting from these changes in the physical environment should be discussed. Friend (1985) indicated that changes in the physical and chemical properties of wetlands may favor the development and maintenance of avian disease problems. This possibility should also be discussed, especially in relation to the cooling pond.

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8DDD The DEIS indicates that the only impacts on wildlife from water quality or hazardous materials at the mine will be related to cyanide exposure. The Service disagrees with this information. Other significant impacts to wildlife are likely to occur as outlined in other sections of this memorandum. These include the effects of increased loads of persistent trace elements in the Humboldt River and its terminal wetlands. The discussion should include a review of existing contaminant problems and existing impacts to wildlife in the lower basin. Included in the discussion should be sections on chemical behavior, biogeochemical cycling, transport (in both dissolved and particulate forms), and fate of potentially toxic constituents in aquatic systems. The potential for the discharge of increased loads of potentially toxic constituents to impact wildlife or exacerbate existing adverse effects in terminal wetlands should be thoroughly evaluated.

**RESPONSE 8CCC**

As stated in the DEIS (page 4-49), ice formation would be inhibited in the Humboldt River, Herrin Slough, and Iron Point Relief Canal for an unknown distance downstream of the mine water discharge point. Waterfowl and predators on waterfowl (possibly including bald eagles) could be attracted to the open water in winter. Discharge water that would be released to these drainages meets temperature standards established by the State of Nevada. No significant effects from temperature and inhibited ice formation on aquatic community composition and structure are anticipated. If changes were to occur, they would likely be subtle and not predicted with accuracy.

The existing Lone Tree Mine dewatering and discharge system to the Humboldt River is a permitted baseline condition for purposes of the EIS. The Proposed Action would extend the period of mine water discharge for 7 years; the maximum dewatering rate of 75,000 gpm would occur for both currently authorized mining and for the Proposed Action. It is not possible to predict changes with any degree of certainty in biotic community composition and structure as a result of adding 7 years to the duration of mine water discharge. Baseline studies are not available to make these predictions nor to determine variability that currently occurs as a result of streamflow alterations, black fly control activities (application of pesticides to the Humboldt River), drought, sediment levels, or other influences resulting from human and natural changes in the environment.

Water in the cooling pond would have an 8-day residence time and would not contain organic materials or other substances that would have potential to increase the potential for avian cholera, botulism, *Salmonella* or other wildlife diseases (see Responses 8A and 8F above for additional information about potential impacts from the cooling pond). The reference cited in the comment (Friend 1985) discusses wildlife health implications of sewage disposal in wetlands and has no relevance to cooling ponds. Friend (1985) states, "Wetland discharges containing large amounts of agricultural waste from poultry processing plants, feedlots, and other types of animal industry are most likely discharges to contain pathogens transmissible to wildlife, while those discharges involving domestic wastes are least likely to contain pathogens of concern to wildlife."

**RESPONSE 8DDD**

See Response 5F to the U.S. Environmental Protection Agency letter (and Appendix F) and Response 7K to the Sierra Club letter in this FEIS for information about loading in the Humboldt River and associated potential impacts.

8EEE

Terrestrial Wildlife, Potential Mitigation and Monitoring Measures. Page 4-49. The DEIS indicates that fencing of the mine pit on public lands is recommended upon mine closure. Fencing of the entire pit, not just those portions on public lands, is essential to prevent human access, primarily to prevent introduction of fish to the pit lake. Please note our comments on potential risks to wildlife with the introduction of fish.

8FFF

Terrestrial Wildlife, Residual Adverse Effects. Pages 4-49 to 4-50. The DEIS indicates that the pit walls will be steep and unvegetated. Information should be provided on what will be done to minimize the possibility of establishment of wetland communities on shallow flooded benches in the pit. Increased contaminant loading to terminal wetlands of the Humboldt River may have severe effects that would persist for an extended period. Such impacts should be evaluated.

8GGG

Aquatic Habitat and Fisheries, Direct and Indirect Impacts. Page 4-50. Inadequate information is presented on water quality in relation to current conditions in the Humboldt River. Please note our previous comments on this issue. This includes the need to compare existing or predicted water quality to aquatic life standards. Continuous discharge of mine dewatering effluent will substantially alter the chemical, physical, and biological character of the Humboldt River. Effects of these changes should be discussed, including changes in community composition and structure.

8HHH

Effects of increased loading of total dissolved solids and trace elements to the Humboldt River should be discussed. This discussion should include a review of existing contaminant problems and existing impacts to fish in the lower Humboldt River basin. Please also note our comments under Terrestrial Wildlife, Direct and Indirect Impacts, Proposed Action.

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**RESPONSE 8EEE**

The fence line will remain on private land; the BLM requires a berm and not a fence around the public land portions of the mine pit.

**RESPONSE 8FFF**

See Response 5F to the U.S. Environmental Protection Agency letter (and Appendix F) and Response 7K to the Sierra Club letter in this FEIS for information about loading in the Humboldt River and terminal wetlands. Final design configuration of the mine pit will attempt to eliminate the presence of shallow flooded benches.

**RESPONSE 8GGG -**

See Response 5F to the U.S. Environmental Protection Agency letter and Appendix F in this FEIS for information about loading in the Humboldt River and associated potential impacts. Continuous discharge of mine water is not expected to substantially alter the chemical, physical, and biological character of the Humboldt River.

Some additional chemical constituents have been added to Table 3-20 (DEIS page 3-58; Summary of Mine Dewatering Discharge Water Quality) and Table 3-12 (DEIS page 3-39; Summary of Humboldt River Water Quality Data in Vicinity of Lone Tree Mine) has been updated with more recent quality data for the Humboldt River (see the Errata section in Chapter 3 of this FEIS for revised Tables 3-12 and 3-20). A new column has been added to revised Table 3-20 that includes water quality standards for the Comus gage control point on the Humboldt River.

Additional information regarding potential impacts to aquatic habitat and fisheries from the Lone Tree Mine discharge is contained in Appendix K.

**RESPONSE 8HHH**

See Response 5F to the U.S. Environmental Protection Agency letter (and Appendix F) and Response 7K to the Sierra Club letter in this FEIS for information about loading in the Humboldt River and associated potential impacts. Additional information regarding potential impacts to aquatic habitat and fisheries from the Lone Tree Mine discharge is contained in Appendix K.

8III The DEIS indicates that increased duration of year round flows in the Humboldt River would likely benefit fish and aquatic invertebrates. Since a database already exists on some taxa of macroinvertebrates before and after dewatering operations began, it would be more useful to analyze these data rather than presume a beneficial effect is occurring in the macroinvertebrate fauna from dewatering operations (see comments on Chapter 3: Affected Environment, Aquatic Habitat and Fisheries, for details).

8JJJ The DEIS also states that populations of some species of fish increase during stable flow conditions, and cites Schlosser (1985). This article compared populations of juvenile and adult age classes of the fish fauna in Jordan Creek, Illinois, that were exposed to very different flow regimes in 1979 and 1980. Abundance of juvenile suckers between years did not vary as greatly as did abundances of juvenile sunfish. Schlosser (1985) asserted that abundance of the juvenile age class in some fishes may be more strongly influenced by physical ("stochastic") factors such as temperature, water level, and storms rather than biotic ("deterministic") processes which may regulate older age classes more strongly. This hypothesis has no relevance to the question of how the structure of a fish fauna under augmented, more "stable" flow regimes will respond.

**RESPONSE 8III**

Discharge of water to the Humboldt River from dewatering operations began in 1991. Data on macroinvertebrate numbers and population dynamics prior to discharge are not adequate to separate potential impacts resulting from increased flows from other environmental factors (e.g., black fly control activities, reduced flows from natural drought, high water temperatures, and floods). These environmental factors interact to affect aquatic biota; however, the relative importance of small incremental effects of increased flows as compared with other factors that also have the potential to affect aquatic organisms cannot be determined from the existing database.

**RESPONSE 8JJJ**

The DEIS section that discusses direct and indirect impacts to aquatic habitat and fisheries (page 4-50) states that it is not known whether or not the Proposed Action would be beneficial, but that it could be beneficial. The DEIS also states that, "Although increased streamflow from mine water discharge would appear to be primarily beneficial to aquatic biota, unknown negative impacts to some species may also result from changes in streamflow volumes and rates."

The hypothesis that abundance of juvenile fishes may be more strongly influenced by physical ("stochastic") factors, rather than biotic ("deterministic") processes is relevant to the question of how the structure of a fish fauna under augmented, more "stable" flow regimes will respond. The stochastic school of thought, regarding which factors are responsible for patterns observed in fish communities, maintains that the abundance of species in an assemblage is determined largely through differential responses to environmental interactions, rather than through biological interactions, although such interactions may exist (Grossman et al., 1982). Changes in streamflows (i.e., increase, decrease, prolonged stable increase such as increased streamflow from mine water discharge) are examples of environmental changes which can affect fish community abundance. Therefore, the stochastic hypothesis would be relevant to the Lone Tree Mine Project.

In Schlosser's (1985) study, high stream discharge resulted in large increases in juvenile minnow and sunfish abundance during stable conditions, although high stream discharge had little influence on the abundance of juvenile suckers and darters. Thus, from this study, one could surmise that increased discharge could be beneficial to sunfish and minnows of the Humboldt River, with no impact on juvenile suckers.

8KKK Aquatic Habitat and Fisheries, Potential Mitigation and Monitoring Measures. Page 4-51. The DEIS proposes limited monitoring for aquatic habitat or fisheries. The Service believes that negative impacts from trace elements may occur. Therefore, we recommend that sampling sites be established both above and below the point of dewatering discharge. Biota from these sites should be collected and analyzed for trace elements. Sample types should include food items of migratory birds, and if feasible, limited samples of bird eggs and livers of pre-flight juveniles. Data interpretation should include information on potential impacts to bird reproduction and survival. Long-term monitoring of trace elements in biota from terminal wetlands should also be included. We are willing to assist in the development of a suitable monitoring plan.

8LLL Aquatic Habitat and Fisheries, Residual Adverse Effects. Page 4-51. The DEIS indicates that no adverse residual impacts to aquatic life will result from the mine expansion. Increased contaminant loading to wetlands of the lower Humboldt River may have severe impacts that would persist for an extended period. The Service also considers the magnitude of ground water recharge after dewatering operations cease to potentially be a residual adverse effect to the aquatic ecosystem of the Humboldt River. The predicted desiccation of springs in the affected area, that may continue for roughly 100 years, is another potential residual adverse effect. All such impacts should be evaluated.

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**RESPONSE 8JJJ (continued)**

Increased flows in the Humboldt River, particularly during the summer months when natural flow conditions are low or non-existent, would increase the amount of aquatic habitat, and therefore, could be beneficial to aquatic resources. For example, as the walleye run has been observed during years of normal or above normal spring runoff, increased seasonal flows from mine dewatering could attract large numbers of walleye to spawn in the lower Humboldt River (French, 1994).

**RESPONSE 8KKK**

Discharge from the Lone Tree Mine is required to meet effluent limitations contained in the discharge permit; therefore, effects on migratory birds and their food supply are expected to be within the range of natural conditions along the Humboldt River. Water quality standards which must be met by SFPG are established at levels which are protective of the environment. Therefore, monitoring of these components of the biological community does not appear to be warranted. SFPG has established a macro-invertebrate sampling program along the Humboldt River to identify biological response to changes in water quality which may be associated with the discharge.

**RESPONSE 8LLL**

Residual adverse effects are those impacts that would occur after the project is completed and would remain, even after mitigation measures are implemented. Increased contaminant loading to wetlands of the lower Humboldt River is not expected to be a long-term effect (see Response 5F to the U.S. Environmental Protection Agency letter (and Appendix F) and Response 7K to the Sierra Club letter in this FEIS for information about loading in the Humboldt River and associated potential impacts).

As stated in the Water Resources section of the DEIS (page 4-41, Residual Adverse Effects), "eventual recovery of the groundwater table after dewatering ceases would allow impacts on spring, seeps, and the Humboldt River to diminish." Although the period required to reach steady-state hydraulic conditions is predicted to be approximately 160 years, most recovery is predicted to occur within about 42 years after cessation of dewatering (see Appendix 5N for revised model predictions). The Proposed Action would not initiate these impacts, but would extend the period of time that impacts would occur. Therefore, groundwater recharge/recovery and its relationship to the Humboldt River and impacted springs is not considered a residual adverse effect. These impacts are discussed in more detail in the DEIS (pages 4-7 to 4-41).

**8MMM** <u>Threatened, Endangered, and Candidate Species, Direct and Indirect Impacts. Page 4-51.</u> The DEIS indicates that the proposed action could have a minor positive impact on bald eagles. The Service expects that the opposite could be true. Waterfowl will be attracted to the cooling ponds throughout the winter, thereby prolonging their exposure to trace elements in the sediments and any food sources that may persist during this period. This would increase trace element exposure to bald eagles attracted to this food source, with the risk of adverse effects. Bald eagles would also be attracted to the pit lake if a fish population becomes established. Fish in the pit lake would be expected to accumulate high concentrations of trace elements, thereby putting bald eagles at risk of excessive exposure. BLM must consult with the Service under Section 7 of the Endangered Species Act of 1973, as amended, because of possible effects on bald eagles.

**8NNN** The Service is concerned about potential impacts from mining operations to birds which use the area. Two active ferruginous hawk nests and a breeding colony of white-faced ibis occur in the study area. Destruction of bird nests and/or their contents may occur if vegetation clearing is conducted during the avian breeding season. Please note our comments under Terrestrial Wildlife, Direct and Indirect Impacts, Proposed Action, as they relate to vegetation clearing.

**8OOO** Degradation of terminal wetlands of the Humboldt River may adversely impact candidate species including white-faced ibis, trumpeter swan, black tern, and western snowy plover. These impacts should be addressed in the statement.

**8PPP** <u>Recreation and Wilderness, Direct and Indirect Impacts. Page 4-54.</u> The DEIS fails to provide information on potential impacts to public health if a fishery is established in the lake. Consumption of fish containing potentially excessive contaminant burdens may present risks to human health.

**RESPONSE 8MMM**

See Response 5B to the U.S. Environmental Protection Agency letter in this FEIS for information about potential effects of trace elements on animal species, including bald eagles, in the pit lake. Fish are not predicted to become established in the Lone Tree pit lake because of toxicity of the water to aquatic organisms. Also see Appendix E for an expanded summary of the ecological risk assessment (ENSR 1996) for the Lone Tree pit lake. Potential toxicity of water in the cooling pond system to waterfowl is discussed in Responses 8A and 8JJ above in this FEIS. Section 7 consultation is not required because impacts to threatened and endangered species are not predicted from the Proposed Action.

**RESPONSE 8NNN**

There is no vegetation removal proposed for the Lone Tree project that would affect ferruginous hawk nests and breeding colony of white-faced ibis.

**RESPONSE 8OOO**

No significant impacts to terminal wetlands of the Humboldt River are expected as a result of the Lone Tree Mine discharge; therefore, impacts to candidate species are not predicted to occur. See Response 5F to the U.S. Environmental Protection Agency letter (and Appendix F) and Response 7K to the Sierra Club letter in this FEIS for information about loading in the Humboldt River and associated potential impacts.

**RESPONSE 8PPP**

A fishery is not predicted to become established in the Lone Tree pit lake because of toxicity of the water to aquatic organisms. Therefore, impacts to public health from consumption of fish would not occur. See Response 5B to the U.S. Environmental Protection Agency letter in this FEIS for information about the pit lake risk assessment. Also see Appendix E for a summary of the risk assessment (ENSR 1996) for the Lone Tree pit lake.

8QQQ

Cumulative Effects, Reasonably Foreseeable Activities, Pages 4-69 to 4-70. It appears that both references to Table 4-6 in this section should instead refer to Table 4-7. In Table 4-7 (Existing and Reasonably Foreseeable Mining Disturbance in the Lone Tree Cumulative Effects Area), the meaning of notations in the comments column for mines 12 through 17 is unclear. This should be clarified in the final EIS.

8RRR

Cumulative Effects, Water Resources, Page 4-75 to 4-77. The DEIS states that most excess mine water discharged to the Humboldt River is not expected to reach the Humboldt Sink. This is unlikely when the dewatering discharges from the Lone Tree Mine alone will amount to one-half of total river flows. Additional dewatering discharges will continue to flow from

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the Newmont Gold Company Gold Quarry Operation, adding to the total flows in the river originating from mine dewatering. Dewatering effluent from other mines may also eventually reach the river. Concentrations of dissolved solids and trace elements in dewatering effluent may be significantly greater than conditions currently existing in the Humboldt River. The statement that the contribution by mine dewatering to the overall load is expected to be negligible is also unreasonable.

8SSS

Evaporation, evapotranspiration, and dissolution from sediments cause water quality degradation as water progresses down the Humboldt River. The construction of Rye Patch Reservoir may have accelerated these processes (Seiler et al. 1993). Monitoring data indicate that dissolved solids increase by approximately 80 percent between Carlin and below Rye Patch Dam. Dissolved solids concentrations are further increased as water passes through agricultural areas in Lovelock Valley (Seiler et al 1993). Once discharged to the terminal wetlands, evaporative water losses further concentrate dissolved solids.

A recent study of wetlands in and near Humboldt WMA found that the quality of irrigation drainage has caused or has the potential to cause harmful effects to fish, wildlife, and human health (Seiler et al. 1993). Levels of arsenic, boron, chromium, copper, dissolved solids, lithium, mercury, molybdenum, selenium, uranium, and zinc in water, sediment, and/or biota exceeded geochemical baseline values, biological effect levels, and/or Nevada water quality standards for the protection of aquatic life or the propagation of wildlife. Dissolved solids, arsenic, boron, mercury, and selenium were of primary concern.

8TTT

With increased loading of trace elements from mine dewatering to the Humboldt River, adverse effects to biota in terminal wetlands will likely be exacerbated. A careful analysis of these concerns in the final document is warranted. Total annual and life-of-mine loads of persistent contaminants discharged from all mines discharging effluent to the Humboldt River or its tributaries should be discussed. Additionally, the average annual loads of these materials in the Humboldt River prior to dewatering effluent discharge should be provided.

**RESPONSE 8QQQ**

The two references to Table 4-6 on pages 4-69 and 4-79 of the DEIS should be Table 4-7. Corrections to these table references are included in the Errata section in Chapter 3 of this FEIS. Table 4-7 in the DEIS (page 4-73) has been revised to clarify the comments column for mines 12 through 17; this information in the DEIS was incorrect and has been replaced in revised Table 4-7 (see the Errata section in Chapter 3 of this FEIS for revised Table 4-7).

**RESPONSE 8RRR**

As stated in the DEIS (page 4-77, 1st paragraph), excess mine water delivered to the Humboldt River would be subject to natural losses through seepage to groundwater, evapotranspiration, agricultural diversions, and storage in Rye Patch Reservoir. The magnitude of these factors can vary considerably from month-to-month, resulting in complex hydrologic system that is difficult to predict with respect to how much water would reach the Humboldt Sink. As stated on page 4-76 of the DEIS (2nd column), increases and decreases in river flow would depend on the sequence of dewatering activities at the various mines.

With respect to the comment about loading to the Humboldt River, see Response 5F to the U.S. Environmental Protection Agency letter (and Appendix F) and Response 7K to the Sierra Club letter in this FEIS. Within the context of long-term natural flow in the Humboldt River, total loading to the river from mine discharges are relatively small because of the limited dewatering periods.

**RESPONSE 8SSS**

Comments noted. See Response 8RRR above. It is apparent that irrigation drainage in the lower Humboldt River drainage has caused or has the potential to cause water quality impacts. The quality of mine discharge water, however, is regulated under NPDES permits with resulting concentrations meeting specified effluent standards that are considered safe for fish, wildlife, and human health.

**RESPONSE 8TTT**

See Response 5F to the U.S. Environmental Protection Agency letter and Responses 7F and 7K to the Sierra Club letter in this FEIS.

8UUU

Cumulative Effects, Aquatic Habitat and Fisheries. Page 4-78. The DEIS indicates that water discharged to the Humboldt River from mine dewatering would improve fisheries throughout the drainage if the water is of "good" quality. No data are presented to support this claim and it is unclear what constitutes "good" quality water. The critical issue is whether water quality entering the Humboldt River from dewatering is suitable for aquatic life. Additional information on effects of high discharge to spawning and recruitment of young life-stages of fishes should also be evaluated. The final EIS should include a more thorough analysis of the

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cumulative impacts, including contaminant exposure, which may occur to the aquatic habitat and fisheries. Cumulative impacts to nearby springs after dewatering operations cease should also be evaluated.

**RESPONSE 8UUU**

Table 3-20 (page 3-58 in the DEIS; Summary of Mine Dewatering Discharge Water Quality) contains representative quality characteristics of the mine discharge water, as well as aquatic life standards. Table 3-20 from the DEIS has been revised and is included in the Errata section in Chapter 3 of this FEIS. The anomalous iron concentration of 1.4 mg/L measured in the mine discharge water during the 4th quarter of 1994 exceeded the aquatic life standard.

Heavy metals and petroleum hydrocarbons bioaccumulate and bioconcentrate in aquatic organisms, including fish and aquatic invertebrates. Due to the myriad of factors which control the amount of consumption of these contaminants in the Humboldt River by aquatic organisms, it is not possible to determine, quantitatively, what the long-term contaminant exposure would be. However, by minimizing the concentrations of these constituents to levels which do not exceed protective levels (i.e., water quality standards), cumulative impacts would be minimized. Because the discharge water is subject to NPDES permit limits, which include protection of aquatic life, further analysis in not warranted.

Streamflow includes discharge, velocity, volume, and timing -- factors that have the potential to impact fish and other aquatic organisms. Adequate flows are essential to support the life history requirements of individual fish species. Since extensive human development of the Humboldt River valley for residential development, agriculture, and transportation corridors, streamflows have been depleted by water extraction and seasonal shifts in flow. During periods of the summer, therefore, the Humboldt River ceases to flow and water stands only in deeper pools or where groundwater discharges to the river channel.

As a result of flow depletions, habitat for fish and other aquatic organisms has declined historically. Although monitoring data to correlate existing fish diversity and numbers with increases in flow do not exist, it seems reasonable to assume that supplementing flow in the river (i.e., increase flows during baseflow periods when water temperatures become lethal to many fish) would provide a net benefit providing water temperature and quality would not be detrimental. Water quality monitoring of the dewatering discharge for the Lone Tree Mine as required by the NPDES permit, indicates that the water is adequate to support resident fish. A cooling pond system and water treatment plant have been constructed for the Lone Tree Mine to ensure that the standards and discharge limits are satisfied.

8VVV

Cumulative Effects, Terrestrial Wildlife (and) Threatened, Endangered, and Candidate Species, Pages 4-78 to 4-79. The DEIS states that fish and wildlife populations would probably increase in the Humboldt River with increased discharge of mine water. No data are presented to support this claim, and research on effects of flow augmentation suggests otherwise (see comments in Chapter 3: Affected Environment, Threatened, Endangered, and Candidate Species and Specific Comments and comments on Chapter 4: Consequences of the Proposed Action and Alternatives, Threatened, Endangered, and Candidate Species, Direct and Indirect Impacts).

8WWW

Cumulative effects are inadequately addressed in these two sections. The creation of a pit lake, the continued maintenance of cooling ponds resulting from the mine expansion, and continued discharge of dewatering effluent will result in increased exposure of migratory birds to trace elements, which in some cases could cause adverse effects. These concerns should be evaluated and addressed in the final EIS.

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### RESPONSE 8VVV

See Response 8UUU above. The first sentence of "Threatened, Endangered, and Candidate Species" section (page 4-78 of DEIS) has been revised to: "Regionally, fish and waterfowl populations could increase in the Humboldt River drainage with increased discharge of mine water." (i.e., changed would probably to could) (see Errata section in Chapter 3 of this FEIS).

### RESPONSE 8WWW

The BLM believes that the cumulative effects analysis contained in the DEIS for terrestrial wildlife and threatened, endangered, and candidate species is appropriate for the geographical area for which adequate information exists. A cumulative impact is the "incremental" impact of the proposed action when added to other past, present and reasonably foreseeable actions (defined by CEQ; 40 CFR 1508.7). The DEIS concluded that the incremental impact of the Lone Tree Mine on these resources would be largely dependent on effects to water resources. To a large extent, these impacts will occur even under the No Action alternative because of Lone Tree Mine operations on private land. The main difference is that dewatering would be extended an additional 7 years and it would take longer for the pit to fill with water after cessation of mining. See Responses 7F and 7G to the Sierra Club letter in this FEIS and Response 8UUU above for additional information about the cumulative effects analysis in this EIS.

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# Letter #9

12 February 1996

Gerald Moritz, EIS Project Manager
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Winnemucca District Office
705 East 4th Street
Winnemucca, Nevada 89445

**RE: DRAFT EIS SANTA FE PACIFIC GOLD CORPORATION LONE TREE MINE EXPANSION**

Dear Mr. Moritz:

Comments are being submitted on behalf of Woodward Properties Ltd. in Pumpernickel Valley. We wish to extend our gratitude for the opportunity to submit comments on the Lone Tree Mine Expansion EIS.

After reviewing the Draft Environmental Impact Statement on the Lone Tree Mine Expansion Project the following comments are suggested. Further study and or explanations in these areas should be included in the final Environmental Impact Statement. The expansion of the Lone Tree Mine will impact a variety of residents and or landowners. For the reassurance of the public I request the following comments be addressed in the Final Environmental Impact Statement.

In section S-2 , Proposed Action, Water Resources: states the following:

> *Based on the predictive computer model results, the cone of depression created by continuation of dewotering activities through yeor 2006 would not affect springs or seeps beyond those already affected in the vicinity of the Lone Tree Mine. Some private wells would experience reduced water levels as a result of the Proposed Action.*

9A Clarification of which wells would be affected by the dewatering need to be included. Lone Tree Mine has a responsibility to the water users of the affected areas to advise of any possible impacts prior to the beginning of the Proposed Action.

9B Chapter 2, page 22, Water Supply/Mine Pit Dewatering, paragraph 1 and page 25, paragraph 1 are noted as stating the number of dewatering wells current and the number of dewatering well to be added, 10 and 28 respectively. The location of these wells is not included in their discussion. With the addition of this information a much clearer understanding can be obtained.

9C Chapter 2, page 51, Project Alternatives, paragraph 2 states:

> *Alternatives are not necessary for mitigating impacts of water quality, water rights, wildlife habitat, agriculturol land use because no significant impacts were identified for these resources.*

**RESPONSE 9A**

The section "Impacts on Wells" beginning on page 4-12 of the DEIS describes predicted impacts to private wells in the vicinity of the Lone Tree Mine. Figure 4-7 (page 4-23) and Table 4-2 (page 4-25) in the DEIS show and list known private wells within the predicted maximum 10-foot groundwater drawdown contour.

**RESPONSE 9B**

The majority of mine dewatering wells (existing and planned) are or will be located on benches within the pit. A few wells will be located outside of the perimeter of the pit at a maximum distance of approximately 800 feet from the pit rim. The proposed configuration of the pit is shown on Figure 2-8 (page 2-33) in the DEIS.

**RESPONSE 9C**

Effects of mine dewatering are not subject to reclamation bonding requirements by the State of Nevada (see NAC 519A). The State of Nevada has authority to address and remedy any adverse impacts on water sources for which water rights are held by another entity. Mitigation measures for water resources are included in Appendix A in this FEIS.

Impacts to the Agricultural community will be felt by dewatering actions. With most any reduction in the groundwater levels, pumping costs will increase. As the quality of any water is reduced the productivity of vegetation shows similar reductions. Alternatives are not only necessary but vital to the assurance of a good relationship with the surrounding water users. A good faith measure of posting a bond to be used in the event that current water consumers are effected by the dewatering practices is essential.

Chapter 2, page 52, Mine Water Discharge Alternatives, paragraph 1 states:

> *.... reinjection into bedrock in the Pumpernickel Valley probably would recirculate at least a portion of the water back to the mine's dewatering system and cause higher dewatering rates. Simon Hydo-Search (1992a) modeled the injection of the excess water,...*

9D Modeling of fracture flow in groundwater is a very difficult task, at the least. The results of such models are highly disputed. It is believed that the most accurate way to understand this type of problem would be by the use of tracer elements. The reinjection alternative may cause the recirculation of some water but will have the least overall impact on the groundwater system.

In Chapter 3, page 15, Precipitation, paragraph 1, it states the following:

> *Average annual precipitation during the period from 1915-91 ranged from 6 to 8 inches in the Lone Tree Mine area. In contrast, total annual precipitation for the project site was 6.86 inches for 1994, 5.26 inches in 1993, and 4.35 inches in 1992.*

9E A search of the Lone Tree Mine climatological observations, Marigold Mine climatological observations and the Battle Mountain climatological record, (a NOAA record) was conducted and no station recorded the stated values. Citations of the location of the data used should be included.

Chapter 3, page 33, Surface Quality, paragraph 13 states:

> *Numerical modeling has been performed by Hydrologic Consultants, Inc. (HCI, 1995a) to predict the groundwater cone of depression or drawdown area surrounding the Lone Tree Mine as a result of dewatering. Results of this study show that the maximum decrease in the flow of 0.2 cfs will occur in the Humbolt River between the Battle Mountain and Comus gages due to mine dewatering and the resulting cone of depression for mining on private land only to year 1999.*

9F It is assumed that this is the same model noted later in Chapter 4, MINEDW. The initial information input to the model need to be made available. Sources pertaining to the credibility of the model must be published in this document if its output is to be believed. Other parameters such as assumptions and boundary conditions can effect the output generated by the model and need to be presented for independent verification.

Chapter 3, page 46, Groundwater Quantity, paragraph 2 states:

**RESPONSE 9D**

As stated in the DEIS (page 2-52, 2nd column, 1st paragraph), SFPG is continuing to evaluate the feasibility of bedrock reinjection. However, the problem of recirculating water is only one of the difficulties associated with injection wells. Of equal concern are problems associated with injection well efficiency. As stated in the DEIS, modeling conducted by Simon Hydro-Search indicated that 8 to 16 injection wells situated over a 160-acre area would be needed to inject only 1,000 gpm. Considering that the maximum predicted dewatering rate for the Lone Tree Mine is 75,000 gpm, a very large number of injection wells would be needed to handle a significant percentage of the anticipated discharge. Injection wells are widely known to be maintenance intensive, and they seldom accept the design rate of reinjection over the long term. This is primarily due to plugging of the formation with fine sand, as well as air entrapment and biofouling problems.

**RESPONSE 9E**

Citations for the annual precipitation data for years 1992, 1993, and 1994 are included with Table 3-4 in the DEIS (page 3-16). The average annual precipitation range of 6 to 8 inches for the period 1915-91 referenced in the DEIS (page 3-15) comes from NOAA records for stations at Battle Mountain, Golconda, and Winnemucca.

**RESPONSE 9F**

See Response 7X to the Sierra Club letter in this FEIS; also see Appendix H in this FEIS for a summary of the groundwater flow model conducted by HCI (1994a). The complete report by HCI (1994a), *"Hydrogeologic Framework and Numerical Ground-Water Flow Modeling of Region Surrounding Santa Fe Pacific Gold Corporation's Lone Tree Mine, Humboldt County, Nevada"*, along with *Addendum I* (HCI 1995b) and *"Predicted Rate and Nature of Infilling of Lone Tree Pit Lake"* (HCI 1996b), contain the data and parameter limits used in the model; these reports are available for review at the BLM Winnemucca District office.

*Based on an analysis of stable Isotope data from groundwater in the mine area, water that enters then mine pit appears to be from recharge areas in the surrounding mountains (PTI 1994). An average annual groundwater recharge rate of 0.54 inches from precipitation has been established for the area around the Lone Tree Mine (HCL 1994a)... There is a net groundwater flow into the hydrologic study area based on a balance calculated for the study area (CHI 1994a).*

9G As there still appears to be a fair amount of doubt as to the origin of the water intersecting the Mine Pit, including a summary of the performed isotope tests is expected. An average groundwater recharge rate of 0.54 inches was calculated, for clarity all factors used to generate this number must be included for verification. This is also true for the mass balance of the study area.

Chapter 3, page 59, Hydrologic Monitoring Program, paragraph 1 states:

*Lone Tree Mine staff collect hydrologic information in the vicinity of the mine site on a periodic basis as part of the ongoing monitoring program. Hydrologic monitoring is intended to establish baseline data and report evolving conditions for both the groundwater levels and quality and surface water flow and quality.*

9H By including an independent, non mine, source of data for both the past (if any) and future hydrologic data, any possible source of bias can and will be eliminated.

9I Chapter 3 should also include the impact of the mine on the agriculture community.

Chapter 4, page 8, Proposed Action, Dewatering System, paragraph 4 states:

*Currently about 10 wells are used for dewatering; the number of dewatering wells would increases as the mine pit continues to expand.*

9J The exact number of wells used for present dewatering should be known and the number of wells expected for the mine pit expansion should be set. Chapter 2 noted the number to be 10 wells at present and 28 expected.

Chapter 4, pages 8 and 11, Dewatering Systems and Groundwater Flow Model, paragraphs 5 and 1-3 respectively.

From page 8 Dewatering Systems:
*A hydrogeologic-based numerical model was developed to predict necessary dewatering rates into the future at the Lone Tree Mine (CHI 1994a, 1994b)*

From pages 8 and 9 Groundwater Flow Model
*In addition, the model predicts the extent of the groundwater drawdown, or cone of depression, that would result from dewatering. Impacts on streamflows in the modeled area also are predicted.*
*The model uses a proprietary computer program "MINEDW" to predict or model three-dimensional groundwater flow with an unconfined water surface using the finite-element method (CHI 119 a). The model was calibrated to known conditions, such as recharge values, water level elevations, stream baseflows, and hydraulic testing results ( drawdown and recovery tests).*

**RESPONSE 9G**

Methods used to calculate groundwater recharge rates are included in the modeling report prepared by HCI (1994a). See Response 7X to the Sierra Club letter in this FEIS.

**RESPONSE 9H**

Comment noted. All available hydrologic data collected in the study area by various entities (e.g., USGS, NDEP, and North Valmy Power Plant) were used to establish baseline conditions.

**RESPONSE 9I**

The Proposed Action would not adversely affect the agricultural community. There is no agricultural activity (crop cultivation) within the study area boundary. The nearest agricultural project – approximately 1,100 acres of alfalfa -- is 15 to 20 miles southwest of the mine area in the Pumpernickel Valley and is not predicted to be affected by groundwater drawdown from the mine pit dewatering.

**RESPONSE 9J**

At the time the DEIS was prepared, SFPG was dewatering the pit area using 10 wells. The number of wells actually used for dewatering purposes would vary throughout the operational life of the mine. A total of 28 wells are expected to be installed to effectively dewater the mine area.

9K This is the heart of the document and does not include any verifiable information. The use of a proprietary model is highly ill-advised. At present there are any number of public computer codes that most likely obtain the same information as MINEDW, such as MODFlow. Public disclosure of the model used is mandatory. The only way to verify that the model is of any value to the prediction of the groundwater is by actual inspection of the code. Public acceptance of this document relies on its release or use of a public accessible model.

The calibration of the model is not disclosed. Recharge values are given in Chapter 3, but as noted above, these values are not substantiated.

The assumptions of a model play a key role in the output generated. A listing of all assumptions should include, at a minimum: 1) Type and location of all boundary conditions 2) Actual hydraulic conductivity used 3)Precipitation input 4) Water levels ( head values) . It states in paragraph 2., of the Groundwater Flow Model section, that an unconfined water surface is assumed. Chapter 3. Notes that most of the water intersecting the Mine Pit is from the Wayne Zone. Chapter 3. later states that the Wayne Zone is assumed to be semiconfined ( page 48.), is this a misprint? The Wayne Zone is also noted as being highly fractured. Steps taken to account for this highly fractured feature need to be listed and explained.

Chapter 4, page 12, Impact on Wells, paragraph 3 states:

> *Only those wells located between the two groundwater contours shown on **Figure 4-7**, however, would be affected solely by the Proposed Action.*

9L Impacts to the areas outside the contours seem to be quite likely. Decreased pumping yields and increased pumping costs outside the groundwater contours should occur. Measures to monitor the areas along the Study Area Boundaries for such occurrences is appropriate.

Chapter 4 should include the monitoring of wells on the outside of the study area as a control group for the monitoring of the water level.

9M A section directed to the subject of actions to be taken in the event that water levels drop beyond that forecasted is requested. As a gesture of good will, Lone Tree Mine should provide an independent consultant to monitor groundwater levels in the surrounding area for reduced water yields for the period equal to that of the dewatering. The consultant should be mutually agreed upon by both the mine and the surrounding community.

Thank you for the opportunity to provide comment on this project and feel free to contact either Robert Brown or myself for any further information. Through the efforts of The Lone Tree Mine, BLM and the various consultants involved with this project, I believe that protection and progression of both the mine and the community will be met.

Sincerely,

John S. Stein
Hydrologist
7293 Blue Falls Cir.
Reno, NV 89511
(702) 784-6134

For : Woodward Properties Ltd.
Robert Brown
874 E. Woodward Road
Manteca, CA 95337
(209) 239-9406

**RESPONSE 9K**

See Responses 7I, 7X, and 7Y to the Sierra Club letter in this FEIS; also see Appendix H in this FEIS for an expanded summary of the groundwater flow model conducted by HCI (1994a). The complete report by HCI (1994a), *"Hydrogeologic Framework and Numerical Ground-Water Flow Modeling of Region Surrounding Santa Fe Pacific Gold Corporation's Lone Tree Mine, Humboldt County, Nevada"*, along with *Addendum I* (HCI 1995b) and *"Predicted Rate and Nature of Infilling of Lone Tree Pit Lake"* (HCI 1996b), contain the assumptions, data, parameter limits, verification, and calibration used in the model; these reports are available for review at the BLM Winnemucca District office. The primary structural zone encountered by the Lone Tree Mine (i.e., Wayne Zone) is highly fractured and semi-confined; these conditions are accounted for in the model.

**RESPONSE 9L**

As stated in the DEIS (page 3-59, Hydrologic Monitoring Program), Lone Tree Mine currently utilizes approximately 60 monitoring wells. Some of these wells (see revised Figure 3-13 in the Errata section of this FEIS) are located outside of the predicted maximum extent of the groundwater cone of depression (e.g., wells 41-3-1, 34-27-1A, and 34-27-1B). These wells will be used to determine if groundwater drawdown impacts from the Lone Tree Mine would extend beyond the predictions. If so, SFPG would increase its monitoring in those areas.

**RESPONSE 9M**

See Appendix A in this FEIS for mitigation measures for wells adversely affected by dewatering activities at the Lone Tree Mine. If adverse impacts to private wells occur, a deeper replacement well or other water source of equivalent yield and quality would be provided. Also see Response 9L above.

## Letter #10

AGRI BEEF CO.

February 16, 1996

Gerald Moritz
EIS Project Manager
Bureau of Land Management
Winnemucca District Office
705 E. 4th Street
Winnemucca, NV 89445

Dear Gerald,

10A Regarding the proposed Lone Tree Mine Expansion, we are extremely concerned about the Proposed Action in one specific area: continuation of mine dewatering. We have already lost the production of Brooks Hot Springs and are aware that further dewatering activities may impact water sources 25 - 30 miles away.

Although Lone Tree Mine representatives are to be commended for their efforts to proactively inform affected interests and mitigate water losses, we are very leery about how the future may unfold and its possible adverse affects to our property value due to dewatering activities. The long-term implications of these activities are not accurately known and will not be known for years. 10B Consequently, before further dewatering activities are approved, Lone Tree and the Bureau of Land Management need to address what possible alternatives are available to insure neighboring interests do not incur or any undue financial, economic, or environmental loss. These entities should be required to warrant or indemnify such affected parties if dewatering activities are to continue or increase.

We are open to any ideas on how best to resolve this issue, but at this time feel it has not been sufficiently addressed.

Sincerely,

Robert Rebholtz, Jr.

RRJ/ktc

1555 Shoreline Drive
Third Floor
P.O. Box 6640
Boise, Idaho 83707
Fax: 208-338-2605
Phone: 208-338-2500

**RESPONSE 10A**

Comment noted. As stated in the DEIS on page 4-26, predicted impacts to springs may extend a distance of 5 to 7.5 miles from the Lone Tree Mine. Three springs within this area have ceased flowing within the last 5 years (Brooks, Treaty Hill, and Hot Pot Springs); two springs (Planck and Stonehouse) were dry in 1990 and prior to initiation of mine dewatering. Impacts to the groundwater table and springs are not expected to occur at a radius of 25 to 30 miles.

**RESPONSE 10B**

Relief from financial or economic losses associated with mine dewatering effects on water sources are addressed by existing State of Nevada water laws. The State Engineer has responsibility for ensuring that sources of water for which valid water rights are held, are protected either by reduction in withdrawal of groundwater or by restitution of water to the affected owner. Nothing in the BLM's decision regarding expansion of the Lone Tree Mine would alter requirements associated with water rights on adjacent water sources.

## Letter #11

# LASER

Legal and Safety Employer Research
DIVISION OF THE WESTERN STATES PIPE TRADES
670 KENTUCKY STREET, GRIDLEY, CA 95948 (916) 846-6352 FAX (916) 846-5274

TO BLM/WINNEMUCCA DISTRICT OFFICE
RE; DEIS--LONE TREE MINE EXPANSION PROJECT

Dear Mr.. Moritz:

Please accept the following comments from LASER regarding this project. LASER has many members and supporters living in northern Nevada, the Humboldt River basin, and in the project vicinity.

CUMULATIVE IMPACTS ON THE HUMBOLDT RIVER

11A This DEIS did contain a 2 page section on the potential cumulative effects of this project on the Humboldt River. LASER believes that this analysis was incomplete because of its narrow geographic scope. The text of this discussion claims the area studied for cumulative impacts goes upstream to Carlin, which would possibly include the impacts from the intense cluster of mines in the Carlin trend, including but not limited to the Barrick and Newmont operations.

11B But the actual area analyzed, as shown in Figure 4-12, is narrowly limited to mines within about a 30 mile radius of the proposed project. This analysis neglected to consider the cumulative effects of the massive watering further upstream on the Humboldt, and the huge discharges of effluent into the Humboldt, from mine dewatering.

In summary, the continued and expanded open pit mining within the Humboldt drainage is causing sweeping and vast changes in the natural hydraulics of this Basin. Billions of gallons of groundwater that currently recharge the Humboldt are now being pumped out. In some cases, this water is directly discharged into the River. In other cases this groundwater is allowed to be evaporated. In yet other cases, this water is reinfiltrated in places that previously, did not have infiltration. All of these manmade changes in the Basin hydraulics have significant adverse impacts.

11C The dewatering and discharges schemes of all of these mines should be studied and co-ordinated in a Master EIS that surveys the cumulative effects of these mines within this River Basin. LASER understands that some cumulative analysis is being prepared as part of a Supplemental EIS conducted because of the large surge in dewatering at the Barrick Mines. The dewatering and discharges from Lone Tree and the other mines in this Basin should be studied in

**RESPONSE 11A**

Page 4-76 of the DEIS (column 2, first full paragraph) includes a description of the effects of discharge from large-scale dewatering operations in the Humboldt River basin; the geographic area described includes mine dewatering projects located in the Carlin Trend area and other portions of the Humboldt River basin.

**RESPONSE 11B**

Page 4-76 of the DEIS (column 2, first full paragraph) describes cumulative effects of dewatering and discharging of water in the Humboldt River Basin as follows: "For example, if several mines in the Humboldt River Basin are discharging excess mine water to the river at the same time, the river would experience increasing flow rates. As dewatering activities cease and groundwater levels reestablish at individual mine areas, Humboldt River flows could diminish in reaches near these mines." At some locations along the Humboldt River, increased flows resulting from discharges would increase the recharge of water to the alluvial system associated with the Humboldt River. In other locations, the discharge water would increase flow in the river channel. These "gaining" and "losing" reaches of the Humboldt River system would continue to influence the amount of recharge that occurs and the in-channel flow characteristics that could result from additional discharge from dewatering projects in the basin.

See Responses 7F and 7H to the Sierra Club letter in this FEIS for additional information regarding cumulative effects analysis.

**RESPONSE 11C**

Comment noted. The DEIS presents an analysis of the direct, indirect, and cumulative effects of the Proposed Action at the Lone Tree Mine. The cumulative effects analysis contained in the DEIS provides a meaningful assessment of the potential cumulative effects which could occur when combining the Proposed Action associated with the Lone Tree Mine expansion with past, present, and reasonably foreseeable activities in the Humboldt River basin.

2

the Barrick SEIS or another more comprehensive EIS. The current Lone Tree DEIS represents a piecemeal analysis of these problems that fails to comply with NEPA.

AIR QUALITY IMPACTS

11D

The proposed project is in two air quality sub-basins; one of which is in non-attainment for particulate matter (PM), and which is also a Class I area. But the DEIS does not address the regulatory concerns triggered by the proposed mine expansion, which will cause a large increase in PM emissions in a non attainment area. There is also no comparison of the air quality impacts from this project, to the allowable Class I air quality increments.

Lacking this analysis, it is likely that this project will cause unmitigated significant adverse impacts to a non-attainment area, and to a Class I area. It's questionable whether these impacts are legal, and comply with state and federal law, including the Nevada SIP.

11E

At one point, the DEIS does compare the PM-10 impacts from the project to the federal standards for PM-10. Again, this comparison in Table 4-1 did not compare the PM-10 impact to the Class I allowable increments under either PSD rules or Forest Service criteria. This comparison did show that the project would cause a 48.5 ug/M3 increase in the maximum levels of PM-10, on a 24 hour average. but the DEIS fails to inform the reviewers that the PM-10 standards are currently under review, in the light of many studies showing conclusively that an increase of 48.5 ug/M3 in PM-10 levels will cause an increase in the death rate of the expose population.

11F

This failure to study the health impacts of PM-10 increases at levels lower than the current standards is significant flaw in the DEIS.

Nor did the DEIS closely study the potential health impacts from toxic air emissions. for instance from silica and metals that are part of the PM-10 emissions from the mine. Airborne silica is often at high concentrations in Nevada, especially near large dust sources such as mines, and is frequently in exceedance of Nevada's recommended air quality standards.

The DEIS should have closely studied and modelled the potential levels of airborne silica and trace metals that will be part of the dust emitted by the mine.

Yours, Jim Wilson

cc: John Williams
attorney Linda Williams
UA Local #350 business manager Bob Lopes

**RESPONSE 11D**

Pages 4-5 and 4-6 of the DEIS indicate that air quality would remain at or near present levels primarily as a result of the mining rate remaining at current levels. Because the mining rate would not change at Lone Tree Mine, sources of particulates, gaseous emissions, and air toxics associated with the Proposed Action would remain at current levels. As a result, there is no need to compare predicted PM-10 concentrations to Class I allowable increments. All sources are currently below applicable ambient air quality standards.

**RESPONSE 11E**

Although PM-10 standards are presently under review by the U.S. Environmental Protection Agency, no changes have been adopted as of this date. SFPG operations at Lone Tree Mine remain in compliance with current requirements.

**RESPONSE 11F**

See Response 11E above. Silica particles and other air-borne metals are reduced in conjunction with the reduction of particulate emissions at the Lone Tree Mine. Silica is a regulated component under the Occupational Safety and Health Administration and the Mining Safety and Health Administration standards and is not a component of the Title III Air Toxics List of the Clean Air Act Amendments of 1990; therefore, silica modeling was not considered necessary for the Lone Tree Mine DEIS.

# Cover Letter For #12, #14, and #15

BOB MILLER
*Governor*

STATE OF NEVADA

JOHN P. COMEAUX
*Director*

**DEPARTMENT OF ADMINISTRATION**
**Capitol Complex**
**Carson City, Nevada 89710**
**Fax (702) 687-3983**
**(702) 687-4065**

February 26, 1996

Gerald Moritz, EIS Project Manager
Bureau of Land Management
Winnemucca District Office
705 East 4th Street
Winnemucca, NV 89445

Re: SAI NV # 96300099 Project: DEIS -- Lone Tree Mine Expansion Project
(1793/3809, NV-932.8, NV-020)

Dear Mr. Moritz:

Enclosed are the comments from the Nevada State Historic Preservation Office, the Division of Environmental Protection, and the Nevada Division of Minerals concerning the above referenced project. These comments constitute the State Clearinghouse review of this proposal as per Executive Order 12372. Please address these comments or concerns in your final decision. If you have any questions please contact either me, at 687-6382, or Julie Butler, Clearinghouse Coordinator/SPOC, at 687-6367.

Sincerely,

Terri Rodefer

Terri Rodefer, Environmental Advocate
Nevada State Clearinghouse

Enclosures

# Letter #12

PETER G. MORROS, Director
L.H. DODGION, Administrator
(702) 687-4670
TDD 687-4678
Administration
Mining Regulation and Reclamation
Water Pollution Control
Facsimile 687-5856
Address Reply to:
Capitol Complex
Carson City, NV 89710

STATE OF NEVADA
BOB MILLER
Governor

DEPARTMENT OF CONSERVATION AND NATURAL RESOURCES
DIVISION OF ENVIRONMENTAL PROTECTION
Capitol Complex
Carson City, Nevada 89710

Waste Management
Corrective Actions
Federal Facilities
Facsimile 885-0868
Air Quality
Water Quality Planning
Facsimile 687-6396
Located at:
333 W. Nye Lane
Carson City, NV 89710

February 2, 1996

CLEARINGHOUSE COMMENTS

NDEP # 96-057
SAI NV # 96300099

TITLE: BLM - Draft EIS for Lone Tree Mine Expansion Project

The Division of Environmental Protection has reviewed the aforementioned State Clearinghouse item and has the following comments:

12A The existing air quality surface disturbance permit will have to be modified.

12B On Page 3-37 and 3-39 it should be known that revisions were made to the toxics water quality standards in July 1994 and November 1995. These changes (petitions 94010 and 96004) should be reflected in Table 3-10 and 3-12. Also, in Table 3-12 generic criteria was being compared to ambient water quality data. This table should use the specific water quality standards for each control point. See NAC 445A.205 for Battle Mountain, NAC 445A.206 for Comus and NAC 445A.144 for toxic standards.

12C On page 3-39 it should be known that the Division conducts a water quality monitoring program at numerous stations on the Humboldt river. This data was not used in Table 3-12.

12D On page 3-58, as stated above, Table 3-20 needs to reflect the most current revisions to the toxic standards.

Attached are adopted Environmental Commissions 94010, 96004 and 96003.

David R. Cowperthwaite

David R. Cowperthwaite
Clearinghouse Coordinator
Division of Environmental Protection

**RESPONSE 12A**

SFPG will modify the existing air quality surface disturbance permit to include an additional area of 25 acres in the mine pit area.

**RESPONSE 12B**

Tables 3-10 and 3-12 in the DEIS (pages 3-37 and 3-39, respectively) have been revised to reflect the changes to some water quality standards (see Errata section in Chapter 3 of this FEIS).

The drinking water standards previously listed in Table 3-12 of the DEIS have been deleted and replaced with control point standards for Battle Mountain and Comus. The control point standards are more applicable to surface water quality than the drinking water standards. The control point standards and aquatic life standards listed in revised Table 3-12 in the Errata section of this FEIS reflect the most current regulations by the State of Nevada.

**RESPONSE 12C**

Table 3-12 in the DEIS (page 3-39) has been revised to incorporate some of the NDEP water quality data for the Humboldt River at the Battle Mountain and Comus gages (see Errata section in Chapter 3 of this FEIS).

**RESPONSE 12D**

Table 3-20 in the DEIS (page 3-58) has been revised similar to Table 3-12 where the drinking water standards previously listed have been deleted and replaced with control point standards for Comus (see Errata section in Chapter 3 of this FEIS). The control point standards are more applicable to surface water quality than the drinking water standards. The control point standards and aquatic life standards listed in revised Table 3-20 reflect the most current regulations by the State of Nevada.

**ATTACHMENT:** Adopted Permanent Regulation of the Nevada State Environmental Commission
Authority: NRS 445.201 and .244

# Letter #13

BOB MILLER
*Governor*

STATE OF NEVADA

DEPARTMENT OF CONSERVATION AND NATURAL RESOURCES

**DIVISION OF WILDLIFE**

1100 Valley Road
P.O. Box 10678
Reno, Nevada 89520-0022
(702) 688-1500 • Fax (702) 688-1595

PETER G. MORROS
*Director*
Department of Conservation and Natural Resources

WILLIAM A. MOLINI
*Administrator*

February 28, 1996

Mr. Gerald Moritz
EIS Project Manager
Bureau of Land Management
Winnemucca District Office
705 E. 4th Street
Winnemucca, Nevada 89445

Dear Gerald:

13A

Thank you for the opportunity to review the Draft EIS for the Lone Tree Mine Expansion Project. The Nevada Division of Wildlife wishes to express concern for the elevated discharge of water into the Humboldt River main channel in Township 36N, Range 41E, Section 13. The DEIS has failed to fully disclose the extent of erosion on this stretch of river immediately below the Red House Ranch's diversion dams since discharge commenced in 1993.

The integrity of the river channel through Section 13 is critical to the continued floodplain health of the river through both the Red House and White House Ranches. If erosion is introduced into this sector sufficient to initiate a head cut's migration upstream, the maintenance of the Red House Ranch diversion dams could become more difficult, threatening dam blowouts which could further threaten river channel integrity upstream on the White House Ranch. The White House Ranch, which was spared the devastating trenching and meander cutting projects of the 1930's, remains the singlemost important block of high-quality wildlife habitat on the Humboldt River below the Lander-Humboldt County line.

Nevada Division of Wildlife has low-level photography and habitat mapping for the Humboldt River floodplain taken in July, 1985, after the intensive flood events of 1984-85. We would like to offer access to these data to your office and Lone Tree Mine personnel to assist in the evaluation of the effects of increased flow through this critical stretch of the main Humboldt River channel since 1993. The photography and mapping could be used as

a baseline to measure present river channel sinuosity against, to determine if channel straightening is occurring which might threaten upstream habitat quality.

**RESPONSE 13A**

See Response 5G to the U.S. Environmental Protection Agency letter and Response 8HH to the U.S. Fish and Wildlife Service letter in this FEIS for information regarding potential erosion impacts to the Humboldt River. There may be potential for some accelerated bank erosion for a short distance downstream from the discharge point (until a steady-state sediment load is reached) during periods when the discharge water would have a lower sediment concentrations than the Humboldt River (i.e., spring runoff). Increased bank erosion could adversely affect riparian vegetation at the edge of the channel. It is not anticipated that mine discharge water would cause channel migrations and widespread collapse of stream banks because stream flows would be well below flood flows that cause the majority of channel modification.

13B Nevada Division of Wildlife also wishes to express concern for the lowering of the water table under the Humboldt River floodplain below the Valmy Power Plant crossing. Although we are unable to articulate the specific processes involved, nor the extent of threat, it seems to us that prolonged dewatering could negatively impact the rich wetland habitats of the White House Ranch, willow stand maintenance, and buffaloberry stand health. All these habitat types have been demonstrated as important to wildlife in our publication, "Wildlife and Wildlife Habitats Associated with the Humboldt River and Its Major Tributaries", which we are sending to you as a courtesy.

**RESPONSE 13B**

Review of completion logs for wells drilled near the Humboldt River indicate alluvial material in the area ranges in thickness from 15 to 40 feet and consists of interbedded silt, sand, and gravel with occasional clay layers. Alluvium in the area is underlain by a relatively thick (greater than 100 feet) sequence of lakebed sediments composed of clay. The presence of poorly sorted silty alluvium, combined with an underlying thick sequence of clay lakebed sediments, will collectively serve to limit the rate of vertical infiltration from the Humboldt River and limit drawdown of groundwater in the vicinity of the river due to mine dewatering. See also the DEIS sections "Impacts to Groundwater Levels" (page 4-11) and "Impacts to Wells" (page 4-12) for information on predicted changes in groundwater levels.

Following mining and cessation of groundwater pumping and discharge, the cone of depression would take approximately 160 years to recover to premining levels; however, 90 percent of the recovery is predicted to occur within 42 years (see Appendix H for revised model predictions). Although the Humboldt River is underlain by relatively impermeable clay layers which tend to segregate the bedrock aquifer from the alluvial aquifer in the vicinity of the Humboldt River, flow in the river is predicted to decrease by a maximum of 0.45 cfs after cessation of dewatering. If shallow groundwater, currently available to riparian vegetation, is drawn down and becomes unavailable to phreatophytes and other riparian vegetation, affected plant communities would become stressed and may die or be replaced by plants adapted to drier conditions. Because of the dynamic nature of riparian plant communities as a result of responses to flooding and sediment deposition, it may be difficult to determine if observed changes in riparian plant communities are attributable to groundwater drawdown, drought, livestock grazing and trampling, or successional changes within the communities.

If plant communities were stressed or killed by lowering of the water table, it is likely that when groundwater in the alluvium returns to near premining levels, plant communities similar to those occupying the riparian area would re-establish. During periods of floods, seeds from willows and cottonwoods would be transported from unaffected areas upstream and deposited on the floodplain. Seeds from other species would also be distributed by wind, wildlife, or natural methods of dispersal. Riparian plant communities are relatively short-lived as one successional stage replaces another. Cottonwood and willow communities require periodic floods and sediment deposition to re-initiate cycles of ecological succession.

13C NDOW's chief concern remains the integrity and stability of the Humboldt River channel. If the river channel is destabilized through increased flows, loss of bank-binding vegetation (willow and meadow grasses) by dewatering, etc., then irreversible channel straightening could occur which would tend to stabilize at a level of deteriorated floodplain condition -- at which point the high-quality wildlife habitats of this stretch of river would be unable to ever recover to pre-project conditions, even after water tables recovered in the future after cessation of mining activities.

13D We believe it is our duty to suggest that permanent degradation in floodplain health could permanently impair the productivity of these valuable private lands, which could lead to permanent loss of private property value. The discussion of effects of dewatering on grazing lands in the DEIS seems by all appearances to be limited to public grazing lands. No disclosure of the effects on private grazing lands could be found; therefore, there is also no mitigation suggested for permanent private property devaluation. A more detailed investigation of these issues by the project proponents seems to be warranted.

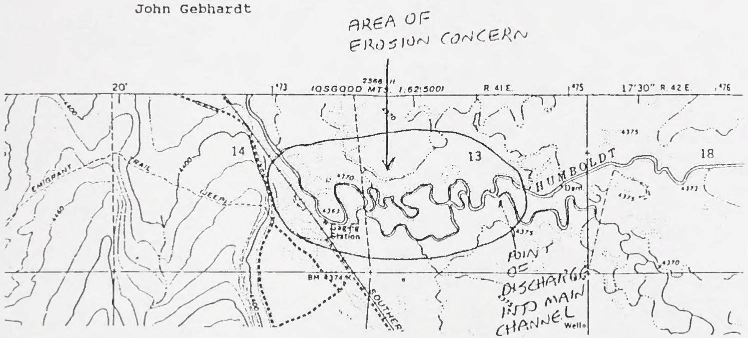
Thanks again for this opportunity to review this project proposal. Please do not hesitate to direct further questions regarding our input to John Gebhardt or Larry Neel at 702-423-5810.

Sincerely,

WILLIAM A. MOLINI, ADMINISTRATOR

Richard T. Heap, Jr.
Regional Manager
Region I

LN:ln/p
CC: Nevada State Clearinghouse
Habitat Bureau
John Gebhardt




**RESPONSE 13C**

See Response 5G to the U.S. Environmental Protection Agency letter and Response 8HH to the U.S. Fish and Wildlife Service letter in this FEIS for information regarding potential erosion impacts to the Humboldt River.

**RESPONSE 13D**

The Proposed Action could affect grazing on private lands primarily as a result of additional springs drying up and extending the period of time over which springs that have dried up remain dry. Loss of springs would render some areas of rangeland, without other water sources, unavailable to grazing. Conversely, springs or water sources that did not dry up would be subjected to more intense use by livestock displaced from rangeland with affected springs. Loss of springs could be mitigated by pumping water to tanks via pipeline for livestock use or by hauling water to stockwater sources.

**ATTACHMENT:** "Wildlife and Wildlife Habitats Associated With the Humboldt River and its Major Tributaries" - Nevada Department of Wildlife

# Letter #14

BOB MILLER
Governor

STATE OF NEVADA

PETER G. MORROS
Director

R. MICHAEL TURNIPSEED, P.E.
State Engineer

DEPARTMENT OF CONSERVATION AND NATURAL RESOURCES
DIVISION OF WATER RESOURCES
Capitol Complex
123 W. Nye Lane
Carson City, Nevada 89710
(702) 687-4380

February 26, 1996

Nevada State Clearinghouse
Dept of Administration
Budget & Planning Division
Blasdel Bldg Room 200
Carson City NV 89710

Re: SAI# 96300099

Dear Ladies & Gentlemen:

14A Allowing the pit to fill with groundwater at mine closure and the attendant evaporation will constitute a permanent appropriation of the underground waters of the State of Nevada. The evaporation will be water lost from development to a beneficial use.

The figure on page 4-36 of 972 acre-feet annually (AFA) for maximum evaporation appears to be too small. The figures elsewhere in the report indicate that direct precipitation on the lake is double counted and actual maximum evaporation is closer to 1152 AFA. The "pristine state" evapotranspiration rate should also be 14B mentioned. Various places in the statement give various rates (pages 3-46, 3-27, 2-54). Please rationalize the figures and note where you come up with your "design" figures, i.e. your base assumption/sources. Calculations based on the various figures range from 29 AFA to 352 AFA

14C The most recent permit issued by this office for mining-milling and dewatering is No. 59627 which, in combination with previous permits, allows a 41,000 gallons per minute (gpm) diversion rate (91.35 cubic feet per second (cfs)) not to exceed 66,133 AFA total diversion of which no more than 3144 AFA may be used consumptively. Applications are on file to raise the diversion rate to the figure stated in the statement (75,000 gpm).

**RESPONSE 14A**

Comment noted. The DEIS on page 4-41 (2nd column, last paragraph) does include evaporative loss from the pit lake as a residual adverse effect for the Lone Tree Mine project.

**RESPONSE 14B**

See Response 8P in the U.S. Fish and Wildlife Service letter in this FEIS for information regarding the evaporation rate from the pit lake. The maximum evaporation rate of 972 acre-feet per year from the pit lake that was used in the DEIS is an error and has been corrected to 840 acre-feet per year (see Errata section in Chapter 3 of this FEIS).

**RESPONSE 14C**

Comment noted.

SAI# 96300099

14D Page 3-59 mentions about sixty (60) monitor wells. A quick search of our data base revealed fifty-one (51) wells specifically authorized for monitor/observation use under waivers. The State Engineer is interested in acquiring long term (post mine closure) use of select monitor wells on this project.

14E No mention was found in the statement with regard to ultimate reclamation of the wells currently in place or to be drilled for this project. Please address well abandonment/plugging.

14F Page S-4 states, "Impacted stockwater sources for which water rights are held would be replaced", and table 3-14 notes LTM supplies water to the user at Brooks Spring. The right by which this is accomplished (permit No.) should be listed. Also, any "good neighbor" stockwatering taps should also be listed with their permit numbers.

Sincerely,

Michael J. Anderson, P.E.
Hydraulic Engineer III

MJA/tdf

**RESPONSE 14D**

Comment noted. Table 3-21 in the DEIS (pages 3-60 & 3-61; Monitoring Wells in the Lone Tree Mine Area) contains a listing of those wells that were provided by SFPG.

**RESPONSE 14E**

Groundwater wells completed for production, monitoring, or dewatering purposes would be abandoned in accordance with State of Nevada requirements.

**RESPONSE 14F**

Table 3-14 in the DEIS (page 3-42) lists Brooks Spring with a water rights certificate number of CER-4283 and vested water right number of VST-V05763. The new water right number for Brooks Spring that allows the Lone Tree Mine to send water to that area via pipeline is 61630T. There are no "good neighbor" stockwatering taps in the study area.

# Letter #15

STATE OF NEVADA
DEPARTMENT OF TRANSPORTATION
1263 S. Stewart Street
Carson City, Nevada 89712

BOB MILLER, Governor

March 1, 1996

In Reply Refer to:

PSD 7.01

Julie Butler, Coordinator
Nevada State Clearinghouse
Department of Administration
Budget Division
Blasdel Building, Room 204
Carson City, NV 89710

Dear Ms. Butler:

The Nevada Department of Transportation has reviewed the project titled DEA - Lone Tree Mine Expansion Project SAI#9630099.

Based on the information submitted, we have the following comments on the proposed project.

15A If visability condition warrants, NDOT will require flashing lights to be placed on existing signs warning of fog and icy road.

Thank you for the opportunity to review this project.

Sincerely,

Thomas J. Fronapfel

Thomas J. Fronapfel, P.E.
Assistant Director
Planning

TJF:PAF:dg

cc: Keith Maki
Jim Dodson

**RESPONSE 15A**

Comment noted.

# Letter #16

STATE OF NEVADA
DEPARTMENT OF BUSINESS AND INDUSTRY
**DIVISION OF MINERALS**
400 W. King Street, Suite 106
Carson City, Nevada 89710
(702) 687-5050 • Fax (702) 687-3957

BOB MILLER
Governor

LAS VEGAS BRANCH:
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RUSSELL A. FIELDS
Administrator

February 16, 1996

Julie Butler, Coordinator
Nevada State Clearinghouse
Department of Administration, Planning Division
Blasdel Bldg., Room 200
Carson City, NV 89710

Re: Nevada SAI #96300099 -- Draft EIS -- Lone Tree Mine Expansion Project -- Santa Fe Pacific Gold Corporation -- Due Date: February 26, 1996

The Nevada Division of Minerals has reviewed the Draft Environmental Impact Statement for the Lone Tree Mine expansion project.

16A

This project will provide for on-going development and production of gold-bearing ores from zones adjacent to the existing Lone Tree Mine. This development and production will allow for the extension of employment and revenue-generation opportunities at this location to the benefit of local economies, Nevada and the nation.

The program outlined is well engineered and demonstrates Santa Fe Pacific Gold Corporation's commitment to environmental excellence.

The Lone Tree Mine expansion project has the full support of the Division of Minerals. We look forward to review and comment on the final EIS once it is available.

If there is any assistance or information we may provide, please contact the Division of Minerals at (702) 687-5050.

Sincerely,

Bill Durbin

Bill Durbin - Chief
Bureau of Abandoned Mine Lands

/bd/sai96099

**RESPONSE 16A**

Comments noted.

# Letter #17

03/11/96 14:41 ☎7036485704 USGS ☑002

DRAFT

In Reply Refer To:
Mail Stop 423

MEMORANDUM

To: Gerald Moritz, Bureau of Land Management

From: James F. Devine
Senior Advisor for Science Applications

Subject: Draft Environmental Impact Statement for Lone Tree Mine Expansion Project, Northern Nevada

The U.S. Geological Survey (USGS) has reviewed the subject draft Environmental Impact Statement (EIS) and offers the following comments:

17A

The impacts on ground-water levels and the effects of pumping on the long-term flow in the Humboldt River are discussed largely on the basis of hydrologic modeling, but the modeling is not described in the EIS. Accordingly, the USGS is unable to verify the utility of the model as a method for evaluating impacts. A detailed description of the model should be provided in the final EIS.

This description should contain:

1. A description of the code and comparison with analytical solutions to permit code verification.

2. A description of initial and boundary conditions and hydrologic properties of the units, their spatial distribution and calibration criteria.

17B

Assuming the geochemical modeling results are correct, the discussion does not appear to be consistent with the results. The statement that the pit lake "would be of good quality in the first 25 years" (page 4-37), seems at odds with data in table 4-5. For instance, an arsenic concentration of 1.2 mg/L is predicted after 1 year after mining (table 4-5), compared with a drinking water standard of 0.05 mg/L. The predicted aluminum concentration at this time also is predicted to be high (1.93 mg/L). Other constituents that appear to be high compared to contaminant criteria include cadmium, copper, selenium, and zinc. These concentrations should be verified since they would appear to be detrimental to wildlife.

## RESPONSE 17A

See Response 7X to the Sierra Club letter in this FEIS; also see Appendix H in this FEIS for an expanded summary of the groundwater flow model conducted by HCI (1994a). The complete report by HCI (1994a), *"Hydrogeologic Framework and Numerical Ground-Water Flow Modeling of Region Surrounding Santa Fe Pacific Gold Corporation's Lone Tree Mine, Humboldt County, Nevada"*, along with *Addendum I* (HCI 1995b), *"Predicted Rate and Nature of Infilling of Lone Tree Pit Lake"* (HCI 1996b), and the summary in this FEIS, contain the assumptions, data, parameter limits, verification, and calibration used in the model. The HCI reports are available for review at the BLM Winnemucca District office.

## RESPONSE 17B

Page 4-37 of the DEIS (column 2, paragraphs 1 and 2) has been modified to reflect more recent pit lake modeling studies by HCI (1996a, 1996b) and PTI (1996). See the Errata section in Chapter 3 of this FEIS. Summaries of these studies are contained in Appendix H (groundwater flow model) and Appendix D (pit lake geochemistry) in this FEIS. In addition, an ecological risk assessment for the Lone Tree pit lake has been prepared by ENSR (1996) and is summarized in Appendix E. This report describes potential effects on wildlife from the pit lake.

03/11/96 14:42 ☎7036485704 USGS

DRAFT

Gerald Moritz 2

17C Some of the geochemical modeling results included need clarification. The adsorption model needs careful evaluation, particularly in relation to arsenic, selenium, and other potentially toxic constituents. The high predicted pH (>8.3) suggests that anion adsorption may not be an efficient removal mechanism. Other important factors that need to be considered in any adsorption model are the effects of competing ions and temperature. The high reported phosphorous (up to 0.59 mg/L; table 3-20) will decrease adsorption of other anions on ferric oxides (see Dzombak and Morel, 1990, Surface complexation modeling, Wiley Interscience). Temperature of the pit water may also affect model predictions.

17D The discussion of drainage from mine waste does not include consideration of the mobility of arsenic and other trace constituents except in the context of acid production. Consideration of the potential for development of alkaline water with high trace constituent concentrations needs to be evaluated.

**RESPONSE 17C**

We agree that there is a general effect of competing ions and water temperature on anion adsorption on ferric oxides. These effects were taken into account in PTI's (1995) pit water chemistry predictions. In addition, adsorption of mercury was incorporated into the revised model (PTI 1996). The reports, *"Assessment of Pit-Lake Chemogenesis and Waste-Rock Characterization at the Lone Tree Mine, Nevada"* (PTI 1995) and *"Revised Prediction of Water Quality in the Lone Tree Mine Pit Lake"* (PTI 1996), are available for review at the BLM Winnemucca District office. A summary of the PTI pit lake study is included in Appendix D in this FEIS. The reported phosphorous value of 0.59 milligrams per liter (mg/L) in Table 3-20 of the DEIS (page 3-58) is an anomalous value with most concentrations below 0.06 mg/L.

**RESPONSE 17D**

Mechanisms which limit formation and migration of acid drainage from overburden disposal facilities (e.g., arid climate and reclamation) also would apply to development and migration of alkaline water with elevated trace element concentrations.

# LIST OF ACRONYMS

| | |
|---|---|
| AFH | amorphous iron hydroxide |
| AGP | acid-generating potential |
| ANP | acid-neutralizing potential |
| ARD | acid rock drainage |
| ATSF | Atchison, Topeka, and Santa Fe Railway Company |
| AUM | animal unit month |
| BIA | Bureau of Indian Affairs |
| BLM | Bureau of Land Management |
| B.P. | before present |
| C | Centigrade |
| CEQ | Council on Environmental Quality |
| CFB | circulating fluidized bed |
| CFR | Code of Federal Regulations |
| cfs | cubic feet per second |
| CIL | carbon-in-leach |
| CIP | carbon-in-pulp |
| COE | U.S. Army Corps of Engineers |
| dB | decibels |
| dBA | A-weighted decibel sound scale |
| DEIS | Draft Environmental Impact Statement |
| DOT | U.S. Department of Transportation |
| EA | Environmental Assessment |
| EIS | Environmental Impact Statement |
| FEIS | Final Environmental Impact Statement |
| FEMA | Federal Emergency Management Agency |
| FHWA | Federal Highway Administration |
| gpm | gallons per minute |
| HDPE | high-density polyethylene |
| kV | kilovolt |
| LTMI | Lone Tree Mining, Inc. |
| MCE | maximum credible earthquake |
| mg/L | milligrams per liter |

| | |
|---|---|
| $\mu g/m^3$ | micrograms per cubic meter |
| MM | million |
| mph | miles per gallon |
| MSHA | Mine Safety and Health Administration |
| MSL | mean sea level |
| NAAQS | national ambient air quality standards |
| NAC | Nevada Administrative Code |
| NAES | Nevada Agricultural Experiment Station |
| NANP | Net Acid Neutralization Potential |
| NAS | National Academy of Sciences |
| NDCNR | Nevada Department of Conservation and Natural Resources |
| NDEP | Nevada Division of Environmental Protection |
| NDH | Nevada Division of Health |
| NDOT | Nevada Department of Transportation |
| NDOW | Nevada Division of Wildlife |
| NDWR | Nevada Division of Water Resources |
| NEPA | National Environmental Policy Act |
| NHPA | National Historic Preservation Act |
| NOAA | National Oceanic and Atmospheric Administration |
| NPDES | National Pollution Discharge Elimination System |
| NRHP | National Register of Historic Places |
| NRS | Nevada Revised Statutes |
| ORV | off-road vehicle |
| OSHA | Occupational Safety and Health Administration |
| PLS | pure live seed |
| POO | plan of operations |
| ppm | parts per million |
| PSD | prevention of significant deterioration |
| PVC | polyvinylchloride |
| R | range |
| RA | resource area |
| RCRA | Resource Conservation and Recovery Act |
| RFA | reasonably foreseeable action |
| RMP | resource management plan |
| RQ | reportable quantity |

| | |
|---|---|
| SARA | Superfund Amendments and Reauthorization Act |
| SCORP | Statewide Comprehensive Outdoor Recreation Plan |
| SCS | Soil Conservation Service |
| SFPG | Santa Fe Pacific Gold Corporation |
| SHPO | State Historic Preservation Office |
| SPPC | Sierra Pacific Power Company |
| SRA | state recreation area |
| SRMA | special recreational management area |
| T | township |
| TDF | tailings disposal facility |
| TIF | tailings impoundment facility |
| TPQ | threshold planning quantity |
| TSP | total suspended particulate |
| USC | United States Code |
| USDA | United States Department of Agriculture |
| USDI | United States Department of the Interior |
| USEPA | United States Environmental Protection Agency |
| USFS | United States Forest Service |
| USFWS | United States Fish and Wildlife Service |
| USGS | United States Geologic Survey |
| VRM | visual resource management |
| WAD | weak acid dissociable |
| WET | whole effluent toxicity |
| WSA | wilderness study area |

# GLOSSARY

**Acre-feet.** The volume of liquid or solid required to cover 1 acre to a depth of 1 foot, which is equivalent to 43,560 cubic feet; measure for volumes of water.

**Activated Carbon.** Highly adsorbent carbon formed by heating granulated charcoal to exhaust contained gases.

**Adit.** A nearly horizontal passage, driven from the surface, by which a mine may be entered, ventilated, and/or dewatered.

**Alluvial.** Pertaining to material or processes associated with transportation or deposition of soil and rock by flowing water (i.e., streams and rivers).

**Alluvium.** Soil and rock deposited by flowing water (i.e., streams and rivers); consists of unconsolidated deposits of sediment, such as silt, sand, and gravel.

**Ambient.** Surrounding, existing.

**Assay.** Qualitative or quantitative analysis of a substance (e.g., ore body).

**Baghouse.** Dust collection and control facility.

**Basic Elements (visual).** The four major elements (form, line, color, and texture) that determine how the character of a landscape is perceived.

**Bio-oxidation.** Process by which chemicals are transformed into their oxidized state by living organisms.

**Carbonaceous Ore.** Ore containing large amounts of carbon.

**Contrast (visual).** The effect of a striking difference in form, line, color, or texture of the landscape features within the area being viewed.

**Critical (Crucial) Habitat.** Habitat that is present in minimum amounts and is a determining factor for population maintenance and growth.

**dBA.** The sound pressure levels in decibels measured with a frequency weighing network corresponding to the A-scale on a standard sound level meter. The A-scale tends to suppress lower frequencies (i.e., below 1,000 Hz).

**Decant.** To remove or pour off a liquid without disturbing associated sediment or solids.

**Decibel (dB).** One-tenth of a Bel is a measure on a logarithmic scale which indicates the ratio between two sound powers. A ratio of 2 in power corresponds to a difference of 3 decibels between two sounds. The decibel is. The basic unit of sound measure.

**Dissolution.** The process of dissolving or, more rarely, melting.

**Disturbed Area.** Area where natural vegetation and soils have been removed.

**Doré Bars.** Product of retort furnace containing gold, silver, and impurities.

**Ecological Site.** A subdivisions of rangeland differentiated by the potential natural vegetation it is capable of supporting.

**Electrolyte.** A substance, usually in solution, which will transmit an electrical current.

**Electrowinning - Electrometallurgy.** The art or science of electrolytically depositing metals, or separating them from their ores or alloys.

**Endangered Species.** Species in danger of extinction throughout all or a significant portion of its range.

**Ephemeral Stream.** A stream or portion of a stream that flows briefly in direct response to precipitation in the immediate vicinity, and whose channel is at all times above the water table.

**Evapotranspiration (ET).** The portion of precipitation returned to the air through evaporation and transpiration.

**Feeder Zones.** Deep pathways followed by mineralizing fluids to form an ore body, often containing rich ore.

**Floodplain.** The low and relatively flat area adjacent to a river or stream. A 100-year floodplain is that area subject to a 1 percent or greater chance of flooding in any given year.

**Flotation.** An ore processing method that separates constituent materials based on their specific gravity.

**Flume.** A structure built in an open channel that constricts water flow through a designed opening to measure rate of water flow.

**Flux.** A substance that promotes the fusing of minerals or metals.

**Forage.** Vegetation used for food by wildlife, particularly big game, and domestic livestock.

**Game Species.** Animals commonly hunted for food or sport.

**Hertz (Hz).** The unit of frequency (i.e., sound) formerly designated as cps - cycles per second.

**Host Rock.** A rock body or wall rock enclosing mineralization.

**Hydraulic Gradient.** For groundwater, the rate of change of total head per unit of distance of flow at a given point and in a given direction.

**Hydrostratigraphic Unit.** Grouping of stratified, mainly sedimentary rocks that have similar groundwater flow conditions.

**Igneous.** Rock or mineral that solidified from molten or partly molten material.

**Intermittent Stream.** Stream that flows only part of the time or during part of the year.

**Isopleth.** A line on a map or chart drawn through points of equal size or abundance.

**Key Observation Point (KOP).** An observer position on a travel route used to determine visible area.

**Kinetic Testing.** A method of testing rock materials to simulate natural weathering. This test is used to test the acid-generating potential of rock.

**Lithic Scatter.** A discrete grouping of flakes of stone left as a byproduct in the tool-making process. Often includes flakes used as tools as well as formal stone tools such as projectile points, knives, or scrapers.

**Makeup Water.** Water needed to supplement water removed by milling or processing of ore and losses to evaporation.

**Maximum Credible Earthquake.** The largest conceivable earthquake that could occur in an area.

**Mesic.** Moist habitats associated with springs, seeps, and riparian areas.

**Meteoric Water.** Water derived from precipitation.

**Mitigation.** Actions to avoid, minimize, reduce, eliminate, replace, or rectify the impact of a management practice.

**Peak Flow.** The greatest flow attained during melting of winter snowpack or during a major precipitation event.

**Perched Water Table.** Unconfined groundwater separated from the underlying main body of groundwater by unsaturated rock.

**Perennial Stream.** A stream that flows throughout the year from source to mouth.

**Permeability.** The capacity of porous rock, sediment, or soil to transmit a fluid.

**pH.** The negative $\log_{10}$ of the hydrogen ion activity in solution; measure of acidity or basicity of a solution.

**PM-10.** Particulate matter less than 10 microns in aerodynamic diameter.

**Probable Maximum Precipitation (PMP).** The greatest depth of precipitation for a given duration that is physically possible over a given storm area at a particular location at a certain time of year.

**Raptor.** A bird of prey (e.g., eagles, hawks, falcons, and owls).

**Refractory Ore.** Ore difficult to treat for recovery of valuable substances.

**Retort.** A furnace in which ore may be heated for removal of its metal content.

**Riparian.** Situated on or pertaining to the bank of a river, stream, or other body of water. Riparian is normally used to refer to plants of all types that grow along streams, rivers, or at spring and seep sites.

**Run-of-Mine Ore.** Ore taken from a mine or pit directly to a mill for processing.

**Scoping.** Procedures by which agencies determine the extent of analysis necessary for a proposed action, (i.e., the range of actions, alternatives, and impacts to be addressed; identification of significant issues related to a proposed action; and the depth of environmental analysis, data, and task assignments needed).

**Sediment Load.** The amount of sediment (sand, silt, and fine particles) carried by a stream or river.

**Seepage Collection System.** A system of drains, ponds, and pumps to collect and return tailings impoundment and embankment seepage.

**Significant.** As used in NEPA, an issue or action that requires consideration of both context and intensity. Context means that the significance of an action must be analyzed at several levels, such as society as a whole as well as regionally and locally. Intensity refers to the severity of impacts (40 CFR 1508.27)

**Sulfides.** That part of a lode or vein not yet oxidized by air or surface water and containing sulfide minerals.

**Static Testing.** A method of determining the acid generating potential of rock materials by measuring the total sulfur and sulfidic content of a sample.

**Steppe.** Vast plains devoid of forest.

**Tackifier.** An agent that binds seed, fertilizer, and mulch to a site, often used when seeding slopes.

**Threatened Species.** Any species of plant or animal that is likely to become endangered within the foreseeable future throughout all or a significant portion of its range.

**Total Suspended Particulates (TSP).** Particulates less than 100 microns in diameter.

**Total Dissolved Solids (TDS).** Total amount of dissolved material, organic or inorganic, contained in a sample of water.

**Total Suspended Solids (TSS).** Undissolved particles suspended in liquid.

**Weak Acid Dissociable (WAD).** Compound that in the presence of a weak acid would disassociate into its ionic forms in solution.

**Weir.** An overflow structure built across an open channel, usually to measure rate of water flow.

**Wetlands.** Areas inundated by surface water or groundwater frequency enough to support vegetative or aquatic life that requires saturated or seasonally saturated soil conditions for growth and reproduction.

# APPENDIX A

(Final Monitoring and Mitigation Measures
for the Lone Tree Mine)

# LONE TREE MINE - MONITORING AND MITIGATION MEASURES

## WATER RESOURCES

The existing hydrologic monitoring program described in Chapter 3, Water Resources of the Draft Environmental Impact Statement (DEIS), shall continue for the proposed Lone Tree Mine expansion. All monitoring results, required by the Nevada State Engineer, shall be provided to the BLM Authorized Officer on a monthly basis. In addition, SFPG will provide a master list including all groundwater monitoring site legal locations, well completion information, date completed, and initial static water level.

SFPG shall continue to update and recalibrate the numerical groundwater model and the pit lake geochemistry model as new data and monitoring results become available. SFPG shall provide an annual report to the BLM Authorized Officer detailing the results of recalibration and any deviations from the original predictions.

Wells that are adversely affected by dewatering activities at the Lone Tree Mine, a deeper replacement well or other water source of equivalent yield and quality will be provided by SFPG.

Results of well monitoring data are to be submitted to the State Engineer, as required, the NDEP, per water pollution control permit requirements, and to the BLM, semi-annually. Monitoring and mitigation measures will continue until the NDEP, State Engineer, and the BLM determine that monitoring and mitigation for impacts are no longer necessary.

SFPG will continue the existing monitoring program for springs located in the vicinity of Lone Tree Mine as identified in Figure 3-11 of the DEIS. These springs will be monitored annually for parameters identified on Table 3-15 (p 3-45) of the DEIS. Springs that are adversely affected by Lone Tree Mine dewatering will be mitigated using one or more of the following methods: (1) by pipeline from another reliable source; (2) completing a vertical well into a deeper aquifer unaffected by dewatering, and pumping the well using electric, solar, or windpower; (3) improving existing spring sites to enhance water yield collection; and/or (4) developing or improving other nearby spring(s) to offset the loss in flow of the impacted spring. Water rights for replaced water would remain with SFPG during the period of mitigation and water replacement methods will be coordinated between the Nevada State Engineer and the BLM.

SFPG will meet monitoring and discharge requirements under the approved discharge permit from NDEP, #NV0021962.

Quality of water in the post-mining pit lake and groundwater quality surrounding the mine pit shall be monitored per requirements of the NDEP water pollution control permit #NEV90058. Monitoring data will be forwarded to the NDEP and the BLM authorized officer. In the event water quality problems are identified in surface, groundwater, or pit lake water, SFPG will evaluate for potential source, and develop and implement mitigation measures acceptable to NDEP and the BLM.

As required by the Nevada State Engineer, SFPG will continue to investigate water disposal options, as identified in Appendix "J" of this FEIS.

SFPG shall develop a monitoring plan for stream bank channel erosion on the Humboldt River. The plan shall include monitoring for turbidity and total suspended solids downstream in the Herrin Slough and the

canal. Should dewatering discharge impact channel stability of the Humboldt River, SFPG will develop and implement mitigation measures and obtain necessary permits through coordination between the U.S. Army Corps of Engineers and NDEP. Monitoring data are to be submitted to the BLM authorized officer (Winnemucca District Office) annually.

## SOILS

Mitigation and monitoring measures for soils will follow those outlined in the BLM Solid Minerals Reclamation Handbook H-3042-1 (BLM 1992). Additional measures are:

Impacts from compaction are to be reduced by ripping and scarifying oxide overburden after placement.

Impacts from pulverization would be minimized by reducing traffic over regraded materials.

In order to reduce soil loss and uncontrolled rilling and gullying on overburden faces, SFPG shall contour the tops of overburden disposal facilities to direct runoff inward on each bench or down dump faces into existing drainage bottoms (if water quality is acceptable).

Varying slope gradients are to be constructed on overburden disposal and heap leach areas to create more drainage diversity.

SFPG will mulch disturbed areas with straw or hay to enhance revegetation, if necessary. Mulching success potential should be evaluated through test plots.

Soil analysis will be conducted on all potential growth medium and areas that fail to meet vegetation release criteria. Such analysis will include salts, sodium, CEC, percent calcium carbonate, nitrate, phosphorus, calcium, magnesium, arsenic, sulfur, zinc, iron, manganese, boron, and soil texture.

SFPG will develop fertilized and non-fertilized test plots to evaluate need for fertilizers for revegetation success. Results will be analyzed and may be incorporated into the reclamation plan.

Records on all test plots will be provided to the BLM.

SFPG shall stabilize growth medium stockpiles by revegetating with an approved seed mixture.

## AVIAN, AQUATIC HABITAT AND FISHERIES

SFPG shall develop a monitoring plan in consultation with the U.S. Fish and Wildlife Service (USFWS) to determine possible impacts to fisheries, avian, and aquatic life from dewatering discharge into the Humboldt River and from the pit lake. Monitoring results will be forwarded to the BLM, USFWS, and Nevada Division of Wildlife (NDOW) annually.

## LIVESTOCK

SFPG will develop alternate water sources in the event that dewatering has impacted livestock water sources. Such alternative water sources shall be built with concurrence of the BLM and State Engineer.

Livestock shall not be allowed to graze on revegetated areas within the mine until revegetation release criteria have been achieved and signed off by the NDEP and BLM.

## RECREATION

Following the completion of mining operations, SFPG shall exclude access and mitigate safety hazards posed by pit walls by reclaiming all pit access roads. On private land, a 4-strand barbed wire fence will be constructed around the perimeter of the open pit approximately 100 feet back from the highwall edge. On public land, a berm will be constructed around the perimeter of the open pit approximately 100 feet back from the highwall edge. The fence and berm shall be posted with warning signs spaced every 2000 feet. The signs would be fabricated of metal warning visitors of unstable conditions and hazards. Signs shall also be installed warning the public of water quality conditions.

## TERRESTRIAL WILDLIFE

Reclamation of overburden disposal areas, leach pads, and tailings impoundment facility, will incorporate the following measures which are intended to enhance the post mining wildlife habitat values of these sites:

a. Individual boulders, rock piles, and areas resembling rock slides will be installed to provide diversity of habitat and perching, feeding, and loafing areas for resident raptor, small mammal, and reptile species inhabiting these sites. The location, distribution, size, and density of these areas will be determined with consultation from the BLM.

b. During reclamation, surfaces of both side slopes and tops of overburden areas, heap leach pads, and tailings facility will be graded to incorporate a series of swales and irregularities in the contour surface, generating micro-climates for post mining flora.

SFPG shall implement mitigating measures to reduce impacts to wildlife from water sources adversely affected by dewatering activities by funding, acquiring, and maintaining alternative water sources including development of new wells, guzzlers, cisterns, and by pumping water or by other appropriate methods. The company will develop a replacement water mitigation plan to be approved by the appropriate agency and shall coordinate with the State Engineer, NDOW, and the BLM.

## AIR RESOURCES

SFPG will ensure that "fine" blowing dust from the reclaimed tailings impoundment will not impact air quality or visibility and will take necessary steps including application of an oxide layer of overburden and growth medium to the tailings impoundment surface to enhance revegetation and reduce blowing dust conditions.

Fugitive dust from all disturbed areas and unpaved roads during the mine life will be controlled using water sprays, chemical stabilization, or other dust controls approved by NDEP.

## GEOLOGY

SFPG shall continue monitoring mine overburden facilities, heap leach pads, tailings impoundment, and the mine pit for acid rock drainage per the existing monitoring program as defined under the Lone Tree Mine water pollution control permit #NEV90058 and the Acid Mine Drainage Mitigation Plan (WESTEC). Mitigation measures include: segregation of sulfide material, encapsulation of sulfides with oxidized overburden, and covering all potentially acid generating rock with a minimum of 5 feet of non-acid generating material. The final lift of all overburden disposal facilities shall be capped with a minimum of 10 feet of oxide material prior to application of growth medium.

Overall side slopes of the overburden disposal areas will be 3H:1V. Reclamation goals for the overburden disposal facilities will include ensuring slope stability, designing more naturally appearing slopes blending with the surrounding topography, and minimizing erosion and excessive soil loss.

All overburden and interburden storage areas, tailings impoundment, and heap leach pads are to be designed, constructed, and maintained to ensure stability during and post mining. SFPG shall apply mitigating measures for slump failures of overburden disposal areas, tailings impoundment, and leach pads, including monitoring for slump failures of facilities during mining operations. In the event such monitoring identifies advanced signs of slump or slope failure, SFPG shall take remedial action to alleviate the problem, including performing the necessary earthwork to stabilize slump or slope failure and establish appropriate drainage, and to deter unstable conditions in a manner acceptable to the BLM authorized officer.

## VISUAL

To eliminate flat surfaces on overburden disposal facilities and heap leach pads, a sufficient number of large boulders of rock shall be placed on top of these features and recontoured.

The long straight profiles of the overburden disposal facilities shall be broken-up by creating pseudo-drainages along the faces of the disposal facilities.

Edges of overburden disposal facility embankments will be rounded to reduce the angular appearance and soften edges.

SFPG will provide BLM with a copy of the analysis evaluating alternative landscape proposals for overburden disposal facilities as required under the NDEP reclamation permit #0073. The final landscape design must be approved by the BLM authorized officer.

## VEGETATION

SFPG shall develop and monitor vegetation test plots for revegetation success through coordination with the BLM.

Revegetation success standards are to be determined by Attachment B of the "Nevada Interim Standards for Successful Revegetation".

SFPG will use variable seed mixes, including shrubs that take advantage of slope and aspect, growth medium depth and landscaped features of post-mining reclamation. These mixes should be determined on the basis of test plots and site-specific goals.

Disturbed and reclaimed areas shall be monitored to determine if undesirable species are becoming established. If weeds become a problem, a control plan shall be developed and approved by the BLM.

The operator shall be responsible for controlling all noxious weeds and other undesirable invading plant species in disturbed areas until revegetation activities have been determined successful and signed off by the BLM authorized officer. The operator shall obtain approval from the authorized officer prior to any and all application of herbicide. All seed shall be tested for noxious, poisonous, or prohibited plant species and the test results submitted to and approved by the BLM, unless certified weed-free seed is procured.

## CULTURAL

SFPG shall comply with requirements of the Surface Management Regulations 43 CFR 3809.2-2(e) pertaining to cultural and paleontological resources. Project workers shall be instructed in cultural resource protection laws and associated responsibilities. If any new cultural resource sites not previously identified in the cultural resource inventories are encountered during facility construction and/or operational activities, work shall stop at the particular location and SFPG shall notify the Winnemucca District Office of the BLM. Work at the location shall be deferred until the Winnemucca District Office of the BLM directs SFPG on how to proceed.

SFPG must notify the BLM authorized officer, by telephone with written confirmation, immediately upon discovery of human remains, funerary objects, sacred objects, or objects of cultural patrimony (as defined in 43 CFR 10.2). In the event that a discovery is found, SFPG must stop activities in the vicinity of the discovery and protect it for 30 days or until notified to proceed by the BLM authorized officer.

# APPENDIX B

(Copy of U.S. Army Corps of Engineers Letter Regarding
Waters of the U.S. and Wetlands)

DEPARTMENT OF THE ARMY
U.S. ARMY ENGINEER DISTRICT, SACRAMENTO
CORPS OF ENGINEERS
1325 J STREET
SACRAMENTO, CALIFORNIA 95814-2922

REPLY TO
ATTENTION OF

July 8, 1996

Regulatory Branch (199400687)(FJL)(FNW26)

Santa Fe Pacific Gold Corp.
Lone Tree Mine
ATTN: Cynthia DeWeese
P.O. Box 388
Valmy, Nevada 89438

Dear Ms. DeWeese:

This letter concerns the SANTA FE PACIFIC GOLD CORPORATION - LONE TREE MINE located in portions of Sections 11, 13, 15, and 23, Township 34 North, Range 42 East, within HUMBOLDT County, Nevada.

We have reviewed and verified the maps delineating the Waters of the United States, including wetlands on the SANTA FE PACIFIC GOLD CORP.- LONE TREE MINE dated November 1993 submitted to us with the Delineation Report prepared by Gibson and Skordal and the Delineation Report for the Proposed Lone Tree Mine Cooling Ponds Project dated January 10, 1995 prepared by Resource Concepts, Inc.. **We concur with the determination that there are approximately 1.48 acres of waters of the United States, including 1.1 acres of wetlands, which will not be impacted, on the project property delineated on the Gibson & Skordal Report, and .81 acres of acres of wetlands on the project property delineated by Resource Concepts, Inc..** Based on the information provided the total of all waters of the United States, including wetlands, that have been impacted or have been proposed to be impacted by the Lone Tree Mine to date are as follows:

| | |
|---|---|
| Previous impacts (Gibson & Skordal 1993) | 0.38 ac |
| Proposed impacts (Resource Concepts 1995) | 0.81 ac |
| TOTAL | **1.19** ac |

The Chief of Engineers has issued Nationwide Permit Number NW26 that allows for the placement of dredged or fill material in waters of the United States in isolated waters or above headwaters. **Your proposed project may be constructed under this authority provided the work meets the conditions listed on the enclosed information sheet. Nationwide Permit 26 requires that if the discharge would cause the loss of waters of the United States greater than one acre the permittee must notify the District Engineer in accordance with the "Notification" general condition.**

Unless the cooling ponds configuration is modified to totally avoid or reduce impacts to under one acre, please provide the necessary information to the agencies on the enclosed information sheet for Pre-Discharge Notification.

The project is located on lands managed by the U.S. Bureau of Land Management (BLM) and therefore they are the lead agency with regards to preparing the required NEPA analysis for the project. We have reviewed the Draft Environmental Impact Statement for the LONE TREE MINE EXPANSION PROJECT, which the Cooling Pond Project is considered to be a part. Based on our coordination with BLM and the information provided by you, it is our understanding that BLM has requested simultaneous processing of other local, state and Federal permitting actions.

33 CFR Part 325.2(d)(4) requires that permits granted prior to other authorizations by other agencies should be conditioned in such a manner as to give those authorities an opportunity to undertake their review without the applicant biasing such review by making substantial resource commitments on the basis of the Department of the Army permit. Therefore, your authorization for this permit is conditioned as follows:

SPECIAL CONDITIONS:

**1. This authorization will become effective upon receipt of the Record of Decision for the Final Environmental Impact Statement and the BLM Rights-of-Way Permit and will remain in effect until the current until the current nationwide permits expire on January 21, 1997 unless the nationwide permit authorization is modified, suspended, or revoked. Work may then proceed subject to the terms and conditions of NW26. You should contact this office if work will extend beyond this date.**

If you have any questions, please write to Mr. Kevin Roukey at our Nevada Office, C. Clifton Young Federal Building, 300 Booth Street, Room 2103, Reno, Nevada 89509, telephone (702) 784-5304, FAX (702) 784-5306.

Sincerely,

Kevin J. Roukey
Chief, Nevada Office

Enclosure

Copies Furnished: w/o Enclosure

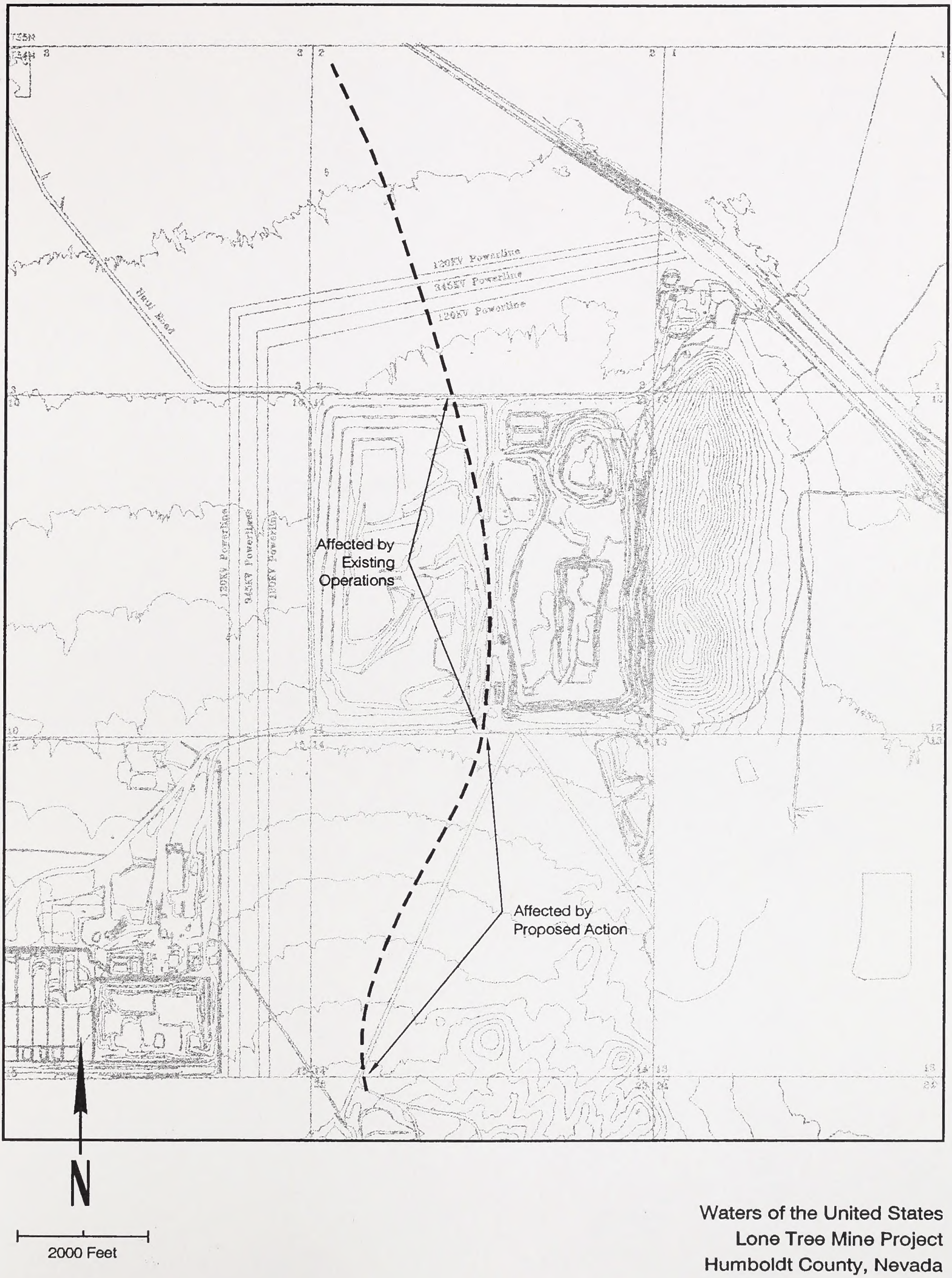
U.S. Fish and Wildlife Service, Nevada State Office, 4600 Kietzke Lane, Building C-125, Reno, Nevada 89502-5093

Nevada Department of Environmental Protection, Bureau of Water Quality Planning, 333 West Nye Lane, Carson City, Nevada 89710

Bureau of Land Management, Winnemucca District Office, 705 East 4th Street, Winnemucca, Nevada 89445

# APPENDIX C

(New Figure Showing Waters of the U.S. Channel
at the Lone Tree Mine)




Waters of the United States
Lone Tree Mine Project
Humboldt County, Nevada
FIGURE Appendix C-1

# APPENDIX D

(Summary of Pit Lake Geochemistry Prediction
for the Lone Tree Mine)

## APPENDIX D
## SUMMARY OF PIT LAKE GEOCHEMISTRY PREDICTION FOR THE LONE TREE MINE

This appendix summarizes the geochemical study and modeling conducted by PTI Environmental Services (PTI) for Santa Fe Pacific Gold Corporation to predict the long-term quality of water in the Lone Tree Mine pit lake. Information presented in this appendix was summarized from the reports: *"Assessment of Pit-Lake Chemogenesis and Waste-Rock Characterization at the Lone Tree Mine, Nevada"* (PTI 1995) and *"Revised Prediction of Water Quality in the Lone Tree Mine Pit Lake"* (PTI 1996); these reports are available for review at the BLM office in Winnemucca.

## INTRODUCTION

Following cessation of mining and dewatering at the Lone Tree Mine, a body of water. or "pit lake" will develop and remain in the mine pit. Dewatering at the Lone Tree Mine was initiated in 1991 and is expected to continue through year 2006 under the Proposed Action. At the end of this mining period, the pit is expected to be up to about 900 feet deep. The water level is predicted by HCI (1996) to recover 90 percent within about 40 years, and reach hydraulic steady state approximately 160 years after cessation of mining.

This appendix is a summary of the modeling effort undertaken to estimate the chemical composition of the Lone Tree pit lake as it evolves from the initial infilling stages to a steady-state condition. Important issues affecting water quality in mine pit lakes include pyrite oxidation and acid generation in the pit walls, leaching of metals from wall rock, chemical reactions and evaporative concentration in the lake, and limnology and oxygen distribution in the final lake.

## GEOLOGY AND STRUCTURE

The Lone Tree Mine is located along the Wayne Zone, a north-south-trending fault zone that is associated with emplacement of the orebody. Important aspects of the geology the affect pit lake chemical predictions are that: (1) rock lower in the pit and on the east wall contains more pyrite and thus is capable of generating more acid than rock elsewhere in the pit; and (2) there will not be a significant amount of limestone exposed in the pit to act as a buffer for acids in the pit lake.

The structural Wayne Zone is hydraulically conductive and will act as the primary conduit for groundwater to the pit. Results of modeling by HCI (1996) indicate that groundwater comprising the Lone Tree pit lake will originate essentially from only three chemistry zones -- Valmy Formation (5%), Havallah Formation (30%), and the Wayne Zone (65%). Analyses of water from the Wayne Zone indicate it is a well-buffered, sodium carbonate groundwater, and concentrations of metals typically associated with refractory ore deposits are relatively low. The natural alkalinity of the groundwater is approximately 300 mg/L $CaCO_3$, which represents a strong capacity to neutralize acidic leachate in the pit lake.

## LABORATORY EXPERIMENTS AND TESTS

Laboratory experiments and tests were conducted to support the modeling efforts for pit lake geochemical predictions. Representative acidic leachate from Lone Tree rocks was mixed with Wayne Zone groundwater, covering the entire range of conditions possible, from pH 2 leachate to pure groundwater. Mixed water

quality data were used as input parameters for the equilibrium speciation program *MINTEQA2*, which was used to model the sorption process. Results demonstrated that over the near-neutral pH range, iron rapidly precipitated as an amorphous iron hydroxide (AFH), and that adsorption to this solid substrate removed a significant amount of other metals.

Lone Tree pit rock was evaluated for chemical stability using both static tests (net carbonate value - NCV) and kinetic tests (humidity cells). Static tests, which determine total acid generating and neutralizing potentials, were conducted on over 200 whole-rock samples. Humidity cells determine whether acid is released under simulated weathering, and were conducted on 24 samples of rock selected to include major rock units and span the range of observed NCVs. The spatially dispersed core samples were collected from areas near the ultimate pit perimeter.

## PYRITE OXIDATION IN PIT WALLS

A numerical model (Davis/Ritchie model) was used to calculate pyrite oxidation in the Lone Tree pit walls. This model was calibrated to the specific climate and material conditions at the Lone Tree Mine by measuring oxidation rates in the Lone Tree sulfide ore stockpile. Wall-rock porosity and rock fragment size were measured directly in the Lone Tree pit before applying the oxidation model to predict wall-rock oxidation. As groundwater flows through the wall rock, acid and metals are leached and transported into the pit lake.

## PIT LAKE CHEMISTRY

Chemical composition of the pit lake was calculated with a model that incorporates static tests (to measure potential acid release), kinetic tests (which measure actual acid and chemical releases), mine plans, groundwater model results, and chemical modeling. Measured releases of acid and metals from wall rock (from static and kinetic tests) were combined with the amount of oxidized rock (from the oxidation model) to calculate chemical loading from wall rock to the pit lake. Wall-rock leachate was then combined mathematically with inflowing groundwater, and the resulting equilibrium chemistry calculated using the geochemical model *MINTEQA2*.

To determine uncertainty in the calculations, the inputs into the final pit lake model were varied using Monte Carlo statistical techniques to calculate a potential distribution of final pit lake compositions. For the period after which the pit lake becomes full, the lake model *CE-QUAL-R1* was used to predict the distribution of thermal, chemical and biological parameters in the pit lake as a function of time.

## MODEL RESULTS

Initial results of the modeling described above that were included in the Lone Tree Mine DEIS indicate that the pit lake generally would be of good quality in the first 25 years as a result of dilution by groundwater, lower amounts of acid-generating rock encountered as the lake rises to higher levels, and continued adsorptive removal of metals. The pit lake was predicted to reach approximately 90 percent of its final level in 25 years. Beyond the initial 25 years of pit infilling, the Lone Tree pit lake would approach a hydraulic steady state where groundwater inflow is balanced by groundwater outflow and evaporative loss.

Evaporation from the pit lake surface would cause some elements to approach a concentration approximately 2.7 times greater than in groundwater inflow. The following primary drinking water standards were predicted to be exceeded in the Lone Tree pit lake: antimony, fluoride, and nickel. In addition, the secondary standards of TDS and pH were predicted to be exceeded. Model results also show that the Lone Tree pit lake would turn over once each year and would be oxygenated (6 to 10 mg/L dissolved oxygen) over its entire depth throughout the year. Long-term water temperature of pit lake water would remain at approximately 5 to 6 degrees Celsius, except at the surface where summer temperatures could reach nearly 30 degrees Celsius.

## REVISED PREDICTION OF PIT LAKE WATER QUALITY

Since completion of the DEIS, several aspects of the hydrologic system are better understood: aquifer characteristics because of dewatering stresses; water quality data from wells throughout the aquifer; and additional static testing data from wall rocks. Therefore, PTI (1996) re-ran the pit-lake model to provide a more accurate prediction of long-term water quality. Quality of groundwater downgradient of the future Lone Tree pit lake also was evaluated to address concerns about impacts to potential receptors and the groundwater resource.

PTI incorporated several improvements to the pit-lake model to refine the uncertainty analysis and to more realistically characterize the pit lake system, including use of shorter time-steps and incorporation of additional geochemical processes. Groundwater inflows into the pit lake were reevaluated by HCI (1996), with a resulting total inflow from three primary zones: Valmy Formation (5%), Havallah Formation (30%), and the Wayne Zone (65%). Finally, since the original pit lake study, the mine plan has changed slightly, and the mine has added sulfide content to the geologic block model. PTI incorporated these data into the revised prediction to provide a more rigorous characterization of wall-rock composition and its potential effects on pit lake chemistry.

### Updated Model Results

There are three primary areas that the updated model differs from the previous results that were reported in the DEIS:

1) The lake will be more concentrated because of less outflow and the pit lake water will thus be subject to more evaporative concentration than previously predicted.

2) Arsenic levels in the lake will be higher. This is due to the increased arsenic concentrations in inflowing groundwater.

3) The updated block model and changes in pit shape may cause differences in wall rock loading to the pit lake.

The following chemical constituents in the Lone Tree pit lake are predicted to exceed primary drinking water standards: antimony, arsenic, fluoride, and thallium. Secondary standards for aluminum and pH are also predicted to be exceeded. Thallium and aluminum were not included in the DEIS as exceeding drinking water standards. **Table Appendix D-1** contains a comparison of predicted concentrations for these parameters for the initial model included in the DEIS and the revised model.

| TABLE APPENDIX D-1<br>COMPARISON OF PREDICTED LONE TREE MINE<br>PIT LAKE WATER QUALITY FOR THE DEIS MODEL<br>VERSUS THE REVISED MODEL INCORPORATED INTO THE FEIS | | | | | | |
|---|---|---|---|---|---|---|
| | Parameter | | | | | |
| Model Run | Sb mg/L | Al mg/L | As mg/L | Fl mg/L | Tl mg/L | pH s.u. |
| Initial DEIS Model (year 25) | 0.211 | 0.38 | 0.094 | 3.06 | 0.0014 | 8.31 |
| Revised FEIS Model (year 24) | 0.022 | 0.59 | 0.56 | 2.6 | 0.018 | 8.8 |
| Initial DEIS Model (steady state) | 0.276 | 0.138 | <0.001 | 6.72 | 0.0014 | >8.3 |
| Revised FEIS Model (steady state) | 0.031 | 0.54 | 0.55 | 4.6 | 0.035 | 9.1 |
| Drinking Water Standard | 0.006 | 0.2 (s) | 0.05 | 4.0 | 0.002 | 6.5 - 8.5 (s) |

Note: Concentrations are the 50th percentile values. (s) indicates secondary drinking water standard. DEIS - draft environmental impact statement; FEIS = final environmental impact statement.

Source: PTI 1995, 1996.

During lake filling, the TDS concentration increases steadily; however, it will not continue to concentrate indefinitely, as outflow eventually will balance the amount of inflowing groundwater, and solutes will approach steady-state concentrations at long times (i.e., hundreds of years) after pit filling is complete. Evaporative concentration results in higher alkalinity and pH in the lake. The probability of acidic pH is much lower than in the earlier model simulation, due to improved estimates for the surface area of net acid-generating rock in the updated geologic block model.

Predicted aluminum concentrations in the pit lake are controlled by pH, with the high pH of 9 resulting in levels of aluminum that exceed the secondary drinking water standard. Predicted antimony concentrations are a result primarily of initial wall-rock loading and later evaporative concentration. Arsenic concentrations predicted to occur in the Lone Tree pit lake are higher than the previous prediction, due primarily to three factors: (1) increased evaporative concentration; (2) higher arsenic concentrations in inflowing groundwater; and (3) higher lake pH. These factors contribute to decreased arsenic desorption.

The thallium concentrations predicted for the Lone Tree pit lake are mostly artifacts of an elevated detection limit for the groundwater analyses used as inputs to the model. Thallium was not detected in 71 or the 75 groundwater analyses used in the prediction, and the concentrations in all four of the water in which it was reported were at or near the detection limit. The thallium detection limit for most of the samples was 0.04 mg/L; whereas, the drinking water standard is 0.002 mg/L. Adsorption of thallium also was not incorporated into the model.

## Predicted Chemistry of Groundwater Downgradient of Pit Lake

Because the predicted median concentrations of several constituents exceed drinking water standards, PTI (1996) evaluated the potential magnitude to which outflow from the Lone Tree Mine pit lake could degrade groundwater. The U.S. Geological Survey solute transport model *PATCHI* (Wexler 1993) was used for the simulations that incorporate advection, dispersion, adsorption, and decay. Results of this modeling show the following:

1) The pit lake pH and aluminum levels will likely exceed the upper secondary standards of 8.5 s.u. and 0.2 mg/L, respectively. These conditions result from the decreasing partial pressure of $CO_2$ in the groundwater as it flows into the lake. Chemical modeling indicates that pH and aluminum concentrations will decrease to below the standards when the lake water enters the aquifer and the pressure of $CO_2$ increases again.

2) At 160 years after mining, groundwater antimony, arsenic, and fluoride concentrations resulting from water exiting the Lone Tree pit lake are predicted to be below drinking water standards within 70, 40, and 15 feet of the alluvial/bedrock contact, respectively. This boundary is the edge of the pit in the northern and southern portions of the pit, and the eastern edge of Lone Tree Hill on the eastern side of the pit.

3) Observed "background" concentrations of antimony, arsenic, and fluoride in groundwater in some wells downgradient of the Lone Tree pit exceed drinking water standards for each of these constituents.

## REFERENCES

Hydrologic Consultants, Inc. (HCI), 1996. Predicted Rate and Nature of Infilling of Lone Tree Pit Lake. Prepared for Santa Fe Pacific Gold Corporation, Valmy, Nevada. June 1996.

PTI Environmental Services (PTI), 1996. Revised Prediction of Water Quality in the Lone Tree Mine Pit Lake. Prepared for Santa Fe Pacific Gold Corporation, Valmy, Nevada. July 1996.

______, 1995. Assessment of Pit-Lake Chemogenesis and Waste-Rock Characterization at the Lone Tree Mine, Nevada. Prepared for Santa Fe Pacific Gold Corporation, Valmy, Nevada. January 1995.

Wexler, E.J., 1993. USGS-Sol: One-, Two- and Three-Dimensional Solute Transport in Groundwater Systems with Uniform Flow, Version 1.0. United States Geological Survey, Techniques in Water-Resources Investigations, Chapter B7, Book 3, Applications of Hydraulics.

# APPENDIX E

(Summary of Pit Lake Risk Assessment
for the Lone Tree Mine)

# APPENDIX E

# SUMMARY OF PIT LAKE RISK ASSESSMENT FOR THE LONE TREE MINE

## INTRODUCTION

This appendix summarizes the screening-level risk assessment completed by ENSR (1996) to evaluate potential risk to wildlife resources and human health attributable to the Lone Tree Mine pit lake. Upon cessation of dewatering, groundwater would eventually fill the pit creating a lake with an area of approximately 280 acres and a maximum depth of about 865 feet. The groundwater that would fill the lake would contain varying concentrations of metals that occur naturally in the groundwater and that have leached from the surrounding rock. ENSR's screening-level risk assessment examines risk associated with all likely routes of exposure including dermal contact, ingestion of water, and ingestion of food that may have been exposed to the pit water.

## APPROACH AND METHODS

ENSR completed the risk assessment using methods described in various documents prepared by the U.S. Environmental Protection Agency (USEPA) and others (Norton et. al., 1988; USEPA, 1992; 1994; Wentsel et al., 1994). In general, the risk assessment is divided into three separate phases: 1) problem formulation, 2) exposure and effects characterization, and 3) risk characterization.

Problem formulation involves characterizing the site, predicting chemical concentrations in the lake, identifying potential receptors and exposure scenarios, and developing conceptual models.

Exposure characterization involves identifying the chemical levels that potential receptors may be exposed to. Effects characterization involves establishing concentrations or doses of chemicals of concern that may cause adverse effects to receptor organisms. Effects data are typically obtained through field investigations and/or laboratory toxicity studies. Impacts to wildlife are generally centered on the protection of populations, while human risk is calculated based on protection of individuals.

Risk characterization, the final phase of a risk assessment, involves evaluating and quantifying the likelihood that adverse effects would occur. Risk is quantified by comparing the expected environmental dose (EED) to the toxicity reference value (TRV). The resulting ratio is known as the hazard quotient (HQ). An HQ less than 1 indicates the concentration of a chemical of concern predicted to be present in the environment is less than the concentration that is expected to cause adverse effects. An HQ greater than 1 indicates that the possibility of adverse effects exists.

## PROBLEM FORMULATION

### Site Characterization

Under the Proposed Action, SFPG would dewater the Lone Tree Mine pit area until year 2006. When mining is terminated, groundwater would begin filling the pit at a relatively rapid rate. After 6 years, the water level

in the pit would have risen approximately 640 feet. The rate at which the pit would fill would begin to slow after about 10 years, and by year 40, the pit will have filled to within 90 percent of the pre-mining water level. Based on numerical modeling efforts (HCI 1996), the pit would approach hydraulic steady-state conditions 162 years after termination of mining.

The rate at which the pit would fill is an important factor in determining the type of habitat that would exist in the pit lake. Aquatic organisms require a certain period of time under stable conditions to establish communities. During the first 5 to 10 years after mining ceases, the rapid increase in water level would preclude the formation of aquatic plant communities. From approximately 40 years after mining is completed until steady state is reached (162 years), the rate of infilling would slow enough such that aquatic plant communities could develop in shallow littoral zones, if other factors (e.g., toxic elements) do not limit establishment.

## Predicted Lake Chemistry

The chemistry of water in the lake was predicted for 5, 40, and 162 years after mining ceased. Five years was selected to represent the lake during its early filling stage when water levels would be rising at a relatively rapid rate. Forty years was chosen because approximately 90 percent of the lake would be filled by that time and the rate of infilling would slow. Hydraulic steady state is predicted to be attained 162 years after termination of mining.

Chemicals of potential concern were chosen based on criteria for both wildlife and human health. Chemicals of potential concern for wildlife include aluminum, antimony, arsenic, boron, cadmium, chromium, copper, fluoride, mercury, nickel, selenium, silver, and zinc. Additional chemicals of potential concern to human health include barium, lead, magnesium, strontium, and thallium. Predicted concentrations of these chemicals are compared to State of Nevada acute and chronic standards for aquatic life, drinking water standards, or other appropriate standards.

## Toxicity Studies

"Mock" pit lake water was prepared in the laboratory using deionized water and reagent grade chemicals to simulate the concentration of the metals of concern at years 5, 40, and 162. Laboratory test plants and animals were then exposed to the mock pit lake water for various lengths of time. Results of the toxicity tests are summarized below:

- Phytoplankton would not survive in the pit lake at any stage of development.
- Zooplankton would not survive in the pit lake at any stage of development.
- Some benthic macroinvertebrates may live in the 40-year pit lake; however, populations would be very low and the ability to reproduce and flourish is in doubt. An insufficient number of insects would emerge as winged adults to provide food for insectivores.
- Although the pit lake would not be toxic to some fish species in the early stages of filling, the lack of a food supply and the absence of shallow areas for breeding would prevent fish populations from developing. As the lake approaches steady state, fish would not survive due to both toxicity and lack of food.

- Aquatic macrophytes (e.g., cattails) may grow in shallow near-shore water. Because of the reduced rate of filling by year 40, shallow water plants may appear as early as 40 years after cessation of mining.

## Receptor Organisms

Various receptor species were selected in consideration of 1) taxonomic levels, 2) food chain niche, 3) habitat, and 4) body size. Using these criteria, the species listed in **Table Appendix E-1** were selected for the risk assessment analysis.

Once the receptor species were identified, ENSR evaluated the potential exposure pathways for each species and assigned each an exposure level. Exposure levels for each species and rationale used to assign the exposure level are summarized in **Table Appendix E-2**.

**TABLE APPENDIX E-1**
**POTENTIAL WILDLIFE RECEPTORS**
**LONE TREE MINE ECOLOGICAL RISK ASSESSMENT**

| Receptor Category | Common Name |
|---|---|
| **Mammals** | |
| Insectivorous Mammal | Little Brown Bat |
| Small Herbivorous Mammal | Blacktailed Jackrabbit |
| Large Opportunistic/Omnivorous Mammal | Coyote |
| Large Herbivorous Mammal/Big Game | Mule Deer |
| **Birds** | |
| Insectivorous Bird | Cliff Swallow |
| Shorebird | Spotted Sandpiper |
| Waterfowl | Mallard |
| Upland Game Bird | Chukar Partridge |
| Opportunistic/Carnivorous Bird, Threatened and Endangered Species | Bald Eagle |

TABLE APPENDIX E-2
EXPOSURE LEVELS FOR WILDLIFE RECEPTOR SPECIES

| Receptor Species | 5 Years | 40 Years | 162 Years | Rationale |
|---|---|---|---|---|
| Little Brown Bat | Chronic | Chronic | Chronic | Exclusively insectivorous and consumes approximately 75% of its body weight each day. Ingests water from lakes and ponds while in flight. There will be no exposure through food ingestion because there will probably be an absence of flying insects emerging from the pit lake. |
| Blacktailed Jackrabbit | NA | NA | NA | Although jackrabbits will drink water in captivity, water requirements in the wild are met entirely through food consumption. |
| Coyote | NA | Chronic | Chronic | Coyotes are unlikely to travel down to the bottom of the pit during the early years of filling. The only complete exposure pathway will be water ingestion. Coyotes may travel to the lake's surface at 40 and 162 years. Since coyotes may den and spend long periods of time near the pit lake, exposure is assumed to be chronic. |
| Mule Deer | NA | Acute | Acute | Very little forage and cover for mule deer in the Lone Tree Mine area. Mule deer would likely visit the mine area sporadically. Mule deer could travel to the surface of the pit lake when the surface is near the pit rim (40 and 162 years). |
| Cliff Swallow | Chronic | Chronic | Chronic | Cliff swallows could use the pit wall for nesting. Chronic exposure through water ingestion is assumed. |
| Spotted Sandpiper | Chronic | Chronic | Chronic | Same exposure scenario as cliff swallow. |
| Mallard | Acute | Acute | Acute | Nesting along the pit lake unlikely because there will be very little cover. Mallards may enter the lake and feed on macrophytes, but their presence should be short-term. |
| Chukar | NA | Chronic | Chronic | Chukars vacated the Lone Tree Mine area when nearby springs dried up. The Lone Tree Mine pit lake may lure chukars back to the area. It is unlikely the chukars will venture into the pit lake at 5 years. But chronic exposure could result at years 40 and 162. |
| Bald Eagle | Acute | Acute | Acute | Bald eagles are not expected to be attracted to the pit lake because the lake will not support fish. Eagles may visit the area during the winter for short periods of time and feed on waterfowl exposed to the lake. |

# EXPOSURE AND EFFECTS CHARACTERIZATION

## Exposure Characterization

The amount of a chemical of potential concern that an organism is exposed to is dependent on the degree of exposure, available routes of exposure, and concentration in the media. Using this information, a dose is calculated for each receptor organism using the following equation:

$$EED = ((C_w \times IR_w) + (C_f \times IR_f))/bw$$

where:

EED = estimated environmental dose (mg/kg/day)
$C_w$ = concentration of a chemical in water (mg/l)
$IR_w$ = water ingestion rate (l/day)
$C_f$ = concentration of a chemical in food (mg/kg)
$IR_f$ = food ingestion rate (kg/day)
bw = body weight (kg)

If either water or food is not a complete pathway, then that part of the equation is eliminated. Standardized equations provided by the USEPA (1993) are used to estimate food and water ingestion rates for wildlife species.

### Effects Characterization

Levels of chemicals that may cause adverse effects to wildlife are derived from the literature. Toxicity data may be acute or chronic. Acute tests are typically short term. An example of an acute endpoint is the dose of a chemical which causes 50 percent mortality in the test organisms ($LD_{50}$). Chronic tests are typically long term and examine sublethal endpoints such as weight, reproduction, immobility, and others. Typical endpoints in chronic studies are the Lowest Observed Adverse Effects Level (LOAEL) and the No Observed Adverse Effects Level (NOAEL). The LOAEL is the lowest concentration or dose tested that causes significant effects to test organisms. The NOAEL is the highest concentration or dose tested that causes no significant effects to test organisms.

The effects levels, or Toxicity Reference Values (TRVs) used in ENSR's risk assessment were dependent on the chemical of potential concern, receptor, and type of exposure. For chronic studies, the TRV was generally a calculated as the geometric mean of the NOAEL and the LOAEL. For acute studies, the TRV is an acute effects level determined to cause significant mortality.

For exposure routes that include food ingestion it is necessary to take into account the quantity of a chemical of potential concern that would be accumulated by food organisms. ENSR assumed that the mallard duck and bald eagle would be exposed to chemicals of potential concern via the food chain. Bioconcentration (the ratio of the concentration of a chemical in tissues to the concentration of the chemical in water) can be derived experimentally or through field studies. In their risk assessment, ENSR used bioconcentration factors determined by Opreska et al. (1994) to account for chemical doses as a result of food chain exposure.

## RISK CHARACTERIZATION

Hazard quotients of four chemicals exceeded 1.0 for four species. HQs that exceed 1.0 are listed in **Table Appendix E-3** along with the corresponding species.

Because of the conservative nature of ENSR's risk assessment, the low HQs are not believed to represent a significant risk. The slightly higher methyl mercury HQs are associated with 1) the greater toxicity of methyl mercury compounds and 2) the tendency of methyl mercury to bioconcentrate to a higher degree than other chemicals. However, the predicted methyl mercury concentrations at all time periods are based on nondetect levels and are therefore likely to be an over-estimate of the actual mercury concentration in the pit lake. Further, the assumption that 25 percent of the mercury will be organic mercury probably over estimates what would actually be present in the pit lake due to the low levels of organic matter expected to be in the lake. It is not believed that methyl mercury or any other chemical will pose a risk to wildlife in the Lone Tree pit lake.

## TABLE APPENDIX E-3
## HAZARD QUOTIENTS THAT EXCEED 1.0
## LONE TREE MINE ECOLOGICAL RISK ASSESSMENT

| Chemical | Years After Mine Closure | | |
|---|---|---|---|
| | 5 | 40 | 162 |
| **Little Brown Bat** | | | |
| Aluminum | 1.198 | 1.067 | 1.011 |
| Arsenic | 1.325 | 1.157 | 1.157 |
| **Cliff Swallow** | | | |
| Methyl Mercury | 2.101 | 2.101 | 4.203 |
| **Spotted Sandpiper** | | | |
| Methyl Mercury | 1.869 | 1.869 | 3.738 |
| **Mallard Duck** | | | |
| Fluoride | <1.0 | <1.0 | 1.015 |

# HUMAN HEALTH RISK ASSESSMENT

## INTRODUCTION

The purpose of the human health screening level risk assessment is to identify those chemicals in the Lone Tree Mine pit lake with the greatest likelihood of causing human health risks. The human health risk assessment evaluates the exposure of recreational users to chemicals in the pit lake at 5, 40, and 162 years post-closure to the Proposed Action. Under the 5 and 40 year scenarios for the Proposed Action pit lake, trespassers may enter the private land, scale down the sloping embankments of the pit, and swim or wade in the lake for a few hours and/or catch and consume fish. Under the steady state condition (162 years), fish consumption is not evaluated because toxicity studies indicate that the pit lake will be acutely toxic to fish.

## EXPOSURE PATHWAYS AND POTENTIALLY EXPOSED PATHWAYS

Trespassers may be exposed to chemicals of potential concern in the Lone Tree Mine pit lake by incidentally ingesting water while swimming, dermal contact with water while either swimming or wading, or by ingesting fish in the pit lake. Toxicity tests performed with mock pit lake water indicate that fish may survive at year 5 after closure. However, there will be partial acute mortality of fish at 40 years and complete mortality at 162 years. Therefore, it was assumed that fish could only be caught and eaten at years 5 and 40.

## QUANTIFICATION OF HUMAN EXPOSURE

Chemical exposure from fish consumption, incidental ingestion of surface water, and dermal exposure to water while swimming was estimated by calculating the acute intake received from each exposure.

The acute intake was calculated as the mass of chemical ingested or absorbed into the skin divided by the mass of the person. The calculated intakes depend on the time spent swimming, the mass of fish and volume of water consumed, the body weight of the exposed person, the dermal absorption rate from water while swimming, and/or the chemical concentrations in fish and lake water.

The acute intake of metals from incidental ingestion while swimming was estimated for a one time only event. It was assumed that an individual would swim for about 2.5 hours and incidentally ingest the lake water at a rate of 50 milliliters per hour (mL/hour).

The acute intake of metals from dermal exposure while swimming was estimated for a one time only event. It was assumed that the entire body (19,400 $cm^2$, the 50th percentile for an adult male), was immersed in the pit lake water for 2.5 hours.

The acute intake of metals from the consumption of fish was estimated for a one time only event. The ingestion rate of fish was assumed to be one meal of about 0.5 pound of fish. The concentration of metals in fish was estimated by multiplying the concentration in water by the bioconcentration factor for fish tissue.

## HUMAN HEALTH TOXICITY ASSESSMENT

The primary measurement endpoint for human health toxicity assessment is the 10-day Health Advisory (USEPA 1989, 1996). The 10-day Health Advisory was selected because it represents the chemical concentration in drinking water that is not expected to cause noncarcinogenic effects for up to 14 days of exposure in a 10-kg child (USEPA, 1989, 1990, 1996). The 10-day Health Advisories for children were used as a conservative estimate of a safe exposure level for acute adult exposures.

Ten-Day Health Advisories are calculated by applying a safety factor on data from animal or human studies and adjusting the dose to a water concentration. The dose is adjusted by multiplying it by the body weight (10 kg) and dividing by the ingestion rate (1 L/day) of a child. The health advisory was then converted back to a dose in order to directly compare it to the expected environmental dose (in water or fish) from the site.

EPA 10-day Health Advisories are not available for all metals of potential concern. For those metals that do not have 10-day Health Advisories, ENSR derived 10-day Health Advisory levels from relevant acute studies available from scientific literature and using appropriate safety factors.

## HUMAN HEALTH RISK CHARACTERIZATION

The Hazard Quotient (HQ) is defined as the ratio of the estimated acute dose to the acute dose derived from the 10-day health advisory for drinking water. HQs were calculated individually for each chemical and exposure pathway evaluated. The total HQ for each metal was also calculated as the sum of the pathway-specific HQs, as it was assumed that one individual could be exposed via all three pathways.

A HQ for a given chemical less that 1.0 implies that acute health effects are unlikely due to exposure from that chemical while a HQ greater then 1.0 indicates a potential health effect risk. Based on the risk characterization calculations, the only constituent with HQ>1 is thallium. The 5- and 40-year HQs for thallium are 3 and 3.5; all HQs at steady state (162 years) are <1. The thallium concentrations predicted for the Lone Tree pit lake, however, are mostly artifacts of an elevated detection limit for the groundwater analysis used as inputs to the geochemical model (see Appendix D in this FEIS). Because of the high degree of fish mortality observed in the toxicity tests, it was assumed that fish would not be able to survive long enough in the pit lake for humans to catch and eat them. Therefore, the food consumption pathway was eliminated at steady state.

## SUMMARY

The chemistry of the Lone Tree Mine pit lake will change during the filling period. Concentrations of several metals will be higher in the final pit lake than in the early filling stages. The higher concentrations are likely to prove toxic to aquatic organisms; thus, along with the anticipated absence of shallow littoral zones, aquatic community development will be severely limited.

The anticipated lack of substantial aquatic communities in the pit lake limits the exposure of wildlife to the chemicals of potential concern. For most receptors, exposure is limited to ingestion of water only. The mallard duck may ingest aquatic plants growing in the lake. However, even if water chemistry allows the growth of aquatic macrophytes, the area of the lake shallow enough to allow growth would be limited. Bald

eagles may visit the lake in the winter and prey on waterfowl such as the mallard. However, the absence of resting sites for eagles and the lack of fish in the lake should limit bald eagle use.

Hazard quotients exceed 1 for the little brown bat, cliff swallow, spotted sandpiper, and mallard. The chemicals involved with these exceedances are aluminum, arsenic, methylmercury, and fluoride. The risk associated with these constituents, however, is believed to be minimal, and the pit lake should pose no risk to wildlife.

For the human health risk assessment, thallium is the only constituent with a HQ>1 (for 5- and 40-year calculations). Fish from the pit lake, however, likely would not be caught and consumed because the water would cause some acute toxicity to the fish. The conservative nature of this risk assessment makes the possibility of risk to humans low.

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# APPENDIX F

(Loading Calculation Tables
for the Lone Tree Mine Discharge to the Humboldt River)

## TABLE APPENDIX F-1
## SUMMARY OF LOADING CONTRIBUTIONS TO THE HUMBOLDT RIVER
## FROM LONE TREE MNE PIT DEWATERING DISCHARGE

| YEAR | DISCHARGE RATE (cfs) | Parameter/Maximum Measured Concentration (mg/l) Arsenic /0.019 Load (tons/yr) | Copper/0.006 Load (tons/yr) | Iron/0.989 Load (tons/yr) | Lead/0.001 Load (tons/yr) | Zinc/0.013 Load (tons/yr) | TDS/486 Load (tons/yr) | Chloride/18 Load (tons/yr) |
|---|---|---|---|---|---|---|---|---|
| 1995 | 98 | 1.8 | 0.6 | 95 | 0.1 | 1.3 | 46,866 | 1,736 |
| 1996 | 95 | 1.8 | 0.6 | 92 | 0.1 | 1.2 | 45,431 | 1,683 |
| 1997 | 97 | 1.8 | 0.6 | 94 | 0.1 | 1.2 | 46,388 | 1,718 |
| 1998 | 102 | 1.9 | 0.6 | 99 | 0.1 | 1.3 | 48,779 | 1,807 |
| 1999 | 111 | 2.1 | 0.7 | 108 | 0.1 | 1.4 | 53,083 | 1,966 |
| 2000 | 118 | 2.2 | 0.7 | 115 | 0.1 | 1.5 | 56,430 | 2,090 |
| 2001 | 120 | 2.2 | 0.7 | 117 | 0.1 | 1.5 | 57,387 | 2,125 |
| 20202 | 120 | 2.2 | 0.7 | 117 | 0.1 | 1.5 | 57,387 | 2,125 |
| 2003 | 117 | 2.2 | 0.7 | 114 | 0.1 | 1.5 | 55,952 | 2,072 |
| 2004 | 120 | 2.2 | 0.7 | 117 | 0.1 | 1.5 | 57,387 | 2,125 |
| 2005 | 145 | 2.7 | 0.9 | 141 | 0.1 | 1.9 | 69,342 | 2,568 |
| 2006 | 167 | 3.1 | 1.0 | 163 | 0.2 | 2.1 | 79,863 | 2,958 |
| | Total (tons) | 26 | 8 | 1,372 | [illegible] | 18 | 674,296 | 24,974 |

## TABLE APPENDIX F-2
## CALCULATED LOADING IN HUMBOLDT RIVER
## PRIOR TO RECEIVING WATER FROM LONE TREE MINE PIT (PRE-1992)

| ANNUAL MEAN DISCHARGE (cfs) | Parameter/Average Measured Concentration (mg/l) Arsenic /0.02 Load (tons/yr) | Copper/0.01 Load (tons/yr) | Iron/0.75 Load (tons/yr) | Lead/0.01 Load (tons/yr) | Zinc/0.01 Load (tons/yr) | TDS/573 Load (tons/yr) | Chloride/73 Load (tons/yr) |
|---|---|---|---|---|---|---|---|
| 324 | 6.4 | 3.2 | 239 | 3.2 | 3.2 | 182,682 | 23,274 |

Notes:
1) Mine pit dewatering discharge rates were obtained from Table 2-6 of the DEIS.
2) Metals, TDS, and chloride concentrations in Lone Tree pit dewatering discharge were obtained from the NPDES Discharge Monitoring Report for December, 1995.
3) Annual mean discharge of the Humboldt River at Comus gage. Period of record 1895 - 1994 (USGS, 1994).
4) Metals, TDS, and chloride concentrations in the Humboldt River prior to receiving discharge water from the Lone Tree Mine pit dewatering program are the average values measured in water samples collected at the Comus gage for the period of record through 1990. Nevada Division of Environmental Protection, Bureau of Water Quality Plan

**TABLE APPENDIX F-3**

**COMPARISON OF MINE PIT DEWATERING LOADS**

**TO PRE-MINING LOADS IN THE HUMBOLDT RIVER**

| | Arsenic(tons) | | | Copper(tons) | | | Iron(tons) | | | Lead(tons) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| YEARS | Mine Discharge | Humboldt | Ratio | Mine Discharge | Humboldt | Ratio | Mine Discharge | Humboldt | Ratio | Mine Discharge | Humboldt | Ratio |
| 1 | 2.2 | 6.4 | 0.34 | 0.7 | 3.2 | 0.22 | 115 | 239 | 0.48 | 0.1 | 3.2 | 0.0313 |
| 12 | 26 | 77 | 0.34 | 8 | 38 | 0.21 | 1,376 | 2,868 | 0.48 | 1 | 38 | 0.0263 |
| 100 | 26 | 640 | 0.04 | 8 | 320 | 0.03 | 1,376 | 23,900 | 0.06 | 1 | 320 | 0.0031 |
| 1000 | 26 | 6,400 | 0.004 | 8 | 3,200 | 0.003 | 1,376 | 239,000 | 0.01 | 1 | 3,200 | 0.0003 |

| | Zinc(tons) | | | TDS(tons) | | | Chloride(tons) | | |
|---|---|---|---|---|---|---|---|---|---|
| YEARS | Mine Discharge | Humboldt | Ratio | Mine Discharge | Humboldt | Ratio | Mine Discharge | Humboldt | Ratio |
| 1 | 1.5 | 3.2 | 0.47 | 56,350 | 182,682 | 0.3 | 2,086 | 23,274 | 0.09 |
| 12 | 18 | 38 | 0.47 | 676,240 | 2,192,184 | 0.3 | 25,046 | 232,740 | 0.11 |
| 100 | 18 | 320 | 0.06 | 676,240 | 21,921,840 | 0.03 | 25,046 | 2,327,400 | 0.01 |
| 1000 | 18 | 3,200 | 0.006 | 676,240 | 219,218,400 | 0.003 | 25,046 | 23,274,000 | 0.001 |

# APPENDIX G

(Supplemental Information Regarding
Acid Producing Potential at the Lone Tree Mine)

# APPENDIX G
# SUPPLEMENTAL INFORMATION REGARDING ACID PRODUCING POTENTIAL AT THE LONE TREE MINE

## OVERBURDEN PILES

**Table Appendix G-1** shows the number of static tests conducted on material to be mined in the proposed expansion, the results of the static tests and the percent of each ore type to be mined under current authorizations and the Proposed Action. The table describes overburden types to be excavated from the Lone Tree Mine and identifies potentially acid-producing rock based upon NDEP criteria (September 14, 1990). NDEP defines neutralizing material as that with a ANP:AGP ratio of 1.2:1.0 or greater. SFPG proposes to encapsulate all acid-generating overburden material (defined by NDEP criteria) with at least 5 feet of neutralizing material.

TABLE APPENDIX G-1
OVERBURDEN MATERIAL ACID-PRODUCING POTENTIAL FROM STATIC TESTS

| Number of Samples[1] | Rock Type | Average ANP[2] (%CaCo$_3$) | Average AGP[3] (%CaCo$_3$) | Average NANP[4] (%CaCo$_3$) | Ratio ANP:AGP (%CaCo$_3$) | Percent of total overburden | Acid Producing[5] |
|---|---|---|---|---|---|---|---|
| 19 | Alluvium (Qal) | 56.96 | 2.8 | 54.16 | 20.34 | 8.0 | No |
| 47 | Havallah Formation, oxidized | 15.92 | 2.18 | 13.74 | 7.30 | 66.1 | No |
| 50 | Havallah Formation, reduced | 26.6 | 21.46 | 5.14 | 1.24 | 18.7 | No |
| 5 | Antler (Edna Mtn. silt and sand, reduced) | 4.86 | 48.97 | -44.1 | 0.10 | 0.6 | Yes |
| 29 | Antler (Edna Mtn. lithic arenite reduced) | 9.81 | 29.5 | -19.69 | 0.33 | 0.6 | Yes |
| 21 | Antler (Battle Mtn., reduced) | 5.47 | 32.88 | -27.41 | 0.17 | 0.6 | Yes |
| 24 | Valmy Formation, reduced | 3.89 | 41.19 | -37.3 | 0.09 | 5.4 | Yes |
| 7 | Tertiary dacite intrusive | 5.62 | 12.11 | -6.49 | 0.46 | <0.1 | Yes |
| 5 | Wayne Zone | 9.54 | 77.61 | -68.07 | 0.12 | <0.1 | Yes |

Source: PTI (personal communication 1994)

1 Number of Net Carbonate Value (NCV) static tests.
2 ANP = Acid-Neutralization Potential.
3 AGP = Acid-Generation Potential.
4 NANP = Net Acid-Neutralization Potential (ANP - AGP).
5 The NDEP (September 14, 1990) criterion for acid-generating rock is a ANP:AGP ratio of 1.2 or greater.

To provide a conservative assessment of acid and metals release from a sample under simulated weathering conditions, kinetic oxidation tests (humidity cells) were performed on rocks collected from the Lone Tree Mine. Kinetic tests were completed on 25 humidity cells, which included five blended composites of reduced (pyritic) materials that will remain in the pit walls. Humidity cells were operated for a 20-week period, where water flushed through the sample was analyzed.

Kinetic tests showed that the reduced, sulfide-bearing rock at the Lone Tree Mine is potentially acid generating and may be a source of acid drainage and elevated metal concentrations. As shown on **Table Appendix G-2**, approximately 26 percent of the overburden is potentially acid-generating material. Ore stockpiles would also contain potentially acid-producing sulfide-bearing material.

Kinetic tests also indicate that approximately 19 percent more of the overburden is potentially acid generating than indicated by static tests. The difference in percent acid-generating rocks reflects the different responses of Havallah Formation reduced rocks under kinetic tests than under static tests. The reduced Havallah Formation, however, has a ANP:AGP ratio of 1.24, allowing it to be deposited on the outside of the dumps according to SFPG overburden segregation criteria. This discrepancy suggests the mitigation plan for the Lone Tree Mine should isolate overburden with an ANP:AGP ratio of 1.3 or less. This analysis lead to the recommendation in the DEIS that all unoxidized overburden be placed within the interior of the overburden stockpiles.

The analysis by PTI (1995) indicated that acid-neutralizing (ANP) overburden is approximately 2.4 times more abundant than acid-generating (AGP) overburden. With a total overburden amount of approximately 140 million tons for authorized mining through year 1999, and approximately 270 million tons for the Proposed Action for years 1999 through 2006, the material with a net acid-neutralizing potential (NANP) would therefore be approximately 170 million tons. The overall ANP:AGP ratio is therefore approximately 2.4. The NDEP (Sept. 14, 1990) criterion for non-acid generating rocks is a ANP:AGP ratio of 1.2 or greater.

Results from the MWMP (Meteoric Water Mobility Procedure) indicate that oxidized Havallah sequence and Quaternary-age alluvium meet NDEP's criteria regarding the "proposed place and manner of use of the materials" (PTI 1995). In contrast, the reduced Havallah, Antler and Valmy lithologies do not meet the NDEP criteria for alternative use and would require a critical review to evaluate the proposed place and manner of use. As the oxidized Havallah and alluvium represent the majority of the material that will be removed from the Lone Tree pit, the bulk of the material removed from the pit may be disposed of without further consideration of the proposed place or manner of usage.

| TABLE APPENDIX G-2<br>CUMULATIVE ACIDITY FOR LONE TREE HUMIDITY CELLS | | | | | | | |
|---|---|---|---|---|---|---|---|
| Number of Humidity Cells[1] | Rock Type | Final pH[2] | Cumulative Acidity[2] (measured) (meq/kg) | Cumulative Acidity[2] (calculated from $SO_4$) (meq/kg) | Neutral-ization gap[2] (meq/kg) | Percent of total over-burden | Acid Producing[3] |
| 0 | Alluvium (Qal) | --[4] | -- | -- | -- | 8.0 | |
| 2 | Havallah Fm, oxidized (Phc) | 6.34 | -- | -- | -- | 66.1 | No |
| 4 | Havallah Fm, reduced (Phpls) | 2.46 | 100 | 200 | 101 | 18.7 | Yes |
| 0 | Antler (Edna Mtn. silt and sand, reduced) (Pems) | -- | -- | -- | -- | 0.6 | -- |
| 7 | Antler (Edna Mtn. lithic arenite reduced) (Peml) | 2.51 | 130 | 225 | 96 | 0.6 | Yes |
| 3 | Antler (Battle Mtn., reduced) (IPb) | 2.35 | 189 | 310 | 1[illegible]1 | 0.6 | Yes |
| 4 | Valmy Fm, reduced (Ov) | 2.44 | 156 | 190 | 34 | 5.4 | Yes |
| 1 | Tertiary dacite intrusive (Tint) | 2.26 | 107 | 187 | 80 | <0.1 | Yes |
| 3 | Wayne Zone (WZ) | 1.92 | 597 | 660 | 63 | <0.1 | Yes |

Source: PTI (personal communication 1994)

1 Number of humidity cells.
2 Mean value. meq/kg = millequivalents per kilogram.
3 Cumulative acidity greater than 1 is considered acid generating.
4 No data available.

**Summary of Overburden Studies**: Overburden investigations summarized by PTI (1995) indicate that reduced rocks at the Lone Tree Mine are the most likely to generate acid and release metals under atmospheric conditions. Reduced rocks constitute 26 percent of the overall overburden volume, whereas the highly neutralizing rocks and alluvium make up 74 percent of the overall volume. The NDEP Meteoric Water Mobility Procedure (MWMP) results indicate that reduced rocks may leach elevated concentrations of metals relative to the oxidized rocks and alluvium. The acid-neutralizing potential of final waste rock mixture is expected to exceed the acid generating potential by a factor of 2.4, which is expected to mitigate acid generation and metals release from the reduced lithologies (PTI 1995). PTI (1995) concluded that the results of the humidity cell tests, in conjunction with the projected mine overburden production schedule, indicate that despite the lack of a major limestone component, the overburden facilities will contain an excess of neutralizing potential and should therefore not release acid as they undergo long-term weathering. This result is partially due to low pyrite content in much of the rock, but humidity cell tests also demonstrated a significant amount of buffering induced by the silicate matrix.

## PIT WALLS

The acid generating potential of the ultimate pit wall surface was determined from analysis of 207 core samples collected within approximately 30 m of the ultimate pit surface. Pit wall oxidation of pyrite was calculated by PTI (1995) using a numerical (Davis/Ritchie) model. The results of the pyrite oxidation model were integrated with a model that calculated the chemistry of the pit lake using static tests, kinetic tests, mine plans, groundwater model results, and chemical modeling. The results of the pit-lake modeling are summarized in the Lone Tree DEIS, Chapter 4, Water Resources, page 4-37.

## TAILINGS

Thirteen samples of Lone Tree ore collected after pilot plant processing were tested by WESTEC (1994) for acid generating potential. Tests were run using four different ore types: Havallah, Antler, Valmy, and an ore composite. For each sample type, autoclave operating conditions were simulated. Testing on the samples included NDEP Meteoric Water Mobility Extraction Procedure, EPA Toxicity Characteristic Leaching Procedure (TCLP) and static testing for acid generation/neutralization potential. In addition, each sample was filtered and the resulting filtrate analyzed for metals and water quality parameters.

Results of the static tests indicated that the samples exhibited a slight excess neutralization potential. However, the excess neutralization potentials were below the minimum threshold of 20 percent established by NDEP (September 1990) and none of the samples met NDEP's criteria of 100 percent excessive neutralization potential using peroxide oxidizable sulfur. Static tests indicated that all of the tailings samples may have a potential to generate acid.

Based on the result of the static tests, additional kinetic tests were conducted on six of the ore samples using humidity cell methods. Kinetic tests generally provide a more realistic determination of acid generating potential than static tests. After 40 weeks of simulated weathering, the tailings samples did not exhibit a potential to generate acid, but sulfate was produced. The pH levels for all samples decreased with time over the 40-week period, but the overall pH levels for all samples remained relatively neutral (6.5 to 8). According to WESTEC (1994), these data suggest that all of the tailings samples exhibit a sufficient amount of neutralizing capacity to buffer acid produced from sulfide oxidation.

The closure plan for the tailings impoundment (WESTEC 1993) states that if the results of routine static and kinetic testing indicate an unacceptable potential for acid generation in the tailings, SFPG will propose to cover the impoundment in a manner so as to inhibit the oxidation of sulfide compounds remaining in the tailings impoundment.

## LEACH PADS

Heap leach pads at the Lone Tree Mine are composed of the same ore types as the tailings impoundment, except that leach pad material is more oxidized than tailings material. Because of oxidized nature of the leach pad material, sulfide minerals have already oxidized and the acid-generation potential is generally less than for tailings. Because kinetic tests of tailings material show the tailings are not acid-generating, leach pad material is also expected to be non-acid generating. In addition, the oxide material and results of test plots indicate the leach pad material is non-acid producing.

## REFERENCES

PTI, 1995. Assessment of Pit-Lake Chemogenesis and Waste-Rock Characterization at the Lone Tree Mine, Nevada. Prepared for Santa Fe Pacific Gold Corporation, Valmy, Nevada. January 1995.

WESTEC, 1994. Tailings Characterization Report for the Lone Tree Mine. WESTEC Project No. 21904, Report No. 898.DR1. Prepared for Santa Fe Pacific Gold Corporation. January 1994.

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# APPENDIX H

(Summary of Numerical Groundwater Flow Model
for the Lone Tree Mine)

# APPENDIX H
# SUMMARY OF NUMERICAL GROUNDWATER FLOW MODEL FOR THE LONE TREE MINE

This appendix summarizes the numerical groundwater flow model (*MINEDW*) conducted by Hydrologic Consultants, Inc. (HCI) for Santa Fe Pacific Gold Corporation to predict the amount of groundwater that must be removed from the Lone Tree Mine area and predict the extent of groundwater drawdown, or cone-of-depression, that would result from dewatering. Information presented in this appendix was summarized from the reports: *"Hydrogeologic Framework and Numerical Ground-Water Flow Modeling of Region Surrounding Santa Fe Pacific Gold Corporation's Lone Tree Mine, Humboldt County, Nevada"* (HCI 1994), *"Addendum I"* (HCI 1995), and *"Predicted Rate and Nature of Infilling of Lone Tree Pit Lake"* (HCI 1996a); these reports are available for review at the Winnemucca BLM office.

## INTRODUCTION

The purpose of HCI's investigation was to numerically model the groundwater flow system in the vicinity of the Lone Tree Mine to estimate the amount of water that would have to be managed during the proposed mining operation and to predict the possible effects of the proposed dewatering and water disposal activities and subsequent pit infilling on the hydrologic system near the mine. The primary investigative tool used in the investigation was a numerical groundwater flow model that uses the three-dimensional, finite-element code *MINEDW*.

## HISTORY OF NUMERICAL CODE AND MODEL DEVELOPMENT

The numerical modeling work described in this document utilizes a numerical code referred to as *MINEDW* that solves the problem of three-dimensional groundwater flow with an unconfined or phreatic surface using the finite-element method. This state-of-the-art code was specifically developed by HCI (Timothy J. Durbin, P.E., a Principal in HCI's Davis, California office is the primary author) to solve problems related to mine dewatering and has several attributes (e.g., simulation of an excavation, calculation of the seepage face on the pit highwall) for that purpose (Atkinson et al. 1992). Complete documentation of *MINEDW*, including a description of its mathematical basis, several validations of its problem-solving capabilities, and instructions for users, has been produced under separate cover (HCI 1992).

The basic core of *MINEDW* originated in an earlier three-dimensional finite-element code, referred to as *FLOW3D*, that was developed by Mr. Durbin when he was employed by the U.S. Geological Survey (USGS) in the early 1980s (Durbin and Berenbrock 1985). It was one of the first codes to incorporate the variable-flux boundary condition as an alternative to generating unnecessarily large model grids. *FLOW3D* was used by the USGS on several projects, and its application in the assessment of a groundwater basin in southern California is documented by Mitten et al. (1988).

*MINEDW* was developed from *FLOW3D* in 1991. It incorporates many of the features of *FLOW3D*, but instead of using a deforming grid, *MINEDW* calculates the position of the phreatic surface using a algorithm for saturated-unsaturated flow. *MINEDW* also includes routines to calculate the height of the seepage face on a pit wall, non-Darcian groundwater flow (which can occur near a pit), element removal (to simulate excavation of a pit), and pit infilling, all of which are fully described and validated in HCI (1992). These attributes, in

conjunction with the discretization detail that can be incorporated into a finite-element grid, give *MINEDW* unique capabilities for solving the problems that were addressed in this investigation.

## CONCEPTUAL HYDROGEOLOGIC MODEL

The available geologic, hydrologic, and climatologic data have been incorporated into a conceptual hydrogeologic model that describes surface water and groundwater flow systems in the study area. The study area encompasses a portion of the Humboldt River drainage basin extending from Battle Mountain to the east to Emigrant Gap to the west and includes parts of the Clovers designated groundwater basin, Pumpernickel non-designated groundwater basin, and the Buffalo Valley non-designated groundwater basin. Essential components of the conceptual hydrogeologic model used in this investigation are: (1) areal and vertical extent and hydraulic characteristics of the primary hydrostratigraphic units and significant geologic structures; (2) recharge to the study area; (3) evapotranspiration from the study area; (4) surface water flow entering and leaving the study area; and (5) outflow from and inflow to the groundwater system in the study area.

Four distinct hydrogeological units occur within the study area:

1) alluvium that occurs extensively in all of the valleys and comprises the largest hydrogeologic unit;

2) basalt that occurs as a thin layer across the northern extent of the study area;

3) regional bedrock that occurs in the adjacent mountains and beneath the alluvial valleys; and

4) regional structures that include dominant northeast trending structures and structures that offset different hydrogeologic units.

The hydraulic properties of each of these units vary significantly between one another and within a given unit. Variations in hydraulic properties are most significant near the mine pit because of the occurrence of the ore deposit. Six predominant hydrogeologic units have been identified in the vicinity of the mine pit:

1) an alluvial unit consisting of interbedded clay, sand, and gravel;

2) the Valmy quartzite on the east side and near the base of the proposed pit;

3) the Antler/Battle unit, which has a relatively high hydraulic conductivity;

4) the Havallah unit within and north of the pit;

5) the Wayne Zone, which hosts the majority of ore and is a conduit that is capable of producing relatively significant volumes of water; and

6) the hydrologically significant geologic structures.

The hydraulic properties of each of these units were determined through aquifer tests and observations made while drilling.

Recharge to groundwater in the Pumpernickel and Clovers basins was estimated using the Maxey-Eakin method. No recharge was assumed throughout the study area at elevations less than 4,600 feet. The total

recharge across the study area is 16.7 cubic feet per second (cfs), or 0.54 inches per year across the 420 square mile area where recharge was applied.

Evapotranspiration in the study area was estimated using the Blaney-Criddle formula. Significant evapotranspiration rates were applied to those areas where greasewood is the dominant plant species and the water table is less than 60 inches.

## MODEL GRID AND DISCRETIZATION

A finite-element grid was constructed that contains 7,096 nodes and 12,109 elements. The grid in the pit area was very finely discretized both for numerical reasons and so that removal of elements from the grid during mining simulations could reasonably represent the geometry of the proposed mine pit. As a result, nearly 75 percent of the model elements lie within a radius of about 3,000 feet from the center of the pit. In the finite-element method, hydraulic properties are assigned to elements, and hydraulic heads and fluxes are associated with nodes. Therefore, every element in the numerical model is assigned a "rock type" with specified values for horizontal and vertical hydraulic conductivity, specific storage, and specific yield (which is only utilized if the water table occurs in the element). The assumption was made that the hydraulic characteristics of similar lithotypes were similar in different areas of the study area.

Regionally, four layers were incorporated into the grid to simulate alluvium, basalt, regional bedrock, and geologic structures. Seven layers of elements were incorporated into the grid in the pit area so that elements could be sequentially removed to simulate the advance of the pit during mining.

## MODEL BOUNDARIES

The mountain ranges in the study area function as local hydrologic divides for surface water and shallow groundwater flow. Consequently, the crest line of the Sheep Creek Mountains to the east and the Edna Mountains to the west were defined in the numerical model to be no-flow boundaries in all layers of the model. The southern and northern boundaries were designated as specified head boundaries using elevations equal to water table elevations in those areas. All model boundaries were designated at sufficient distances from the proposed pit such that stresses on the alluvium from mine dewatering and pit infilling would not reach boundaries. The base of the numerical model was designated as a no-flow boundary except for a small area along the bottom of the Wayne Zone that was designated a constant head boundary. This designation allows simulation of water entering the bottom of the Wayne Zone from greater depths than the modeled area as a result of dewatering.

An evapotranspiration subroutine (*EVAP*) was included in the model that accounts for evapotranspiration in phreatophytic areas. The evapotranspiration of groundwater occurs as a linear function of depth from land surface to an extinction depth. When the water level drops below the extinction depth of 17 feet, evapotranspiration ceases.

Flow in the Humboldt River and Iron Point Relief Canal were simulated using the *RIVER* subroutine of *MINEDW*. This subroutine calculates seepage from or to the surface water systems depending on the hydraulic gradient between the surface water systems and the water table and the leakance factor of the river beds. River bed leakance values were used as a calibration tool.

## MODEL CALIBRATION AND SENSITIVITY ANALYSIS

Calibration was the final step in preparing the numerical groundwater flow model for use in making predictive simulations. Heads calculated in the steady-state calibration are used as the initial heads for subsequent transient simulations with the model, both for transient calibration and predictive simulations. The goal of steady-state calibration is to match heads and fluxes calculated by the numerical model to actual conditions in the absence of significant hydraulic stresses (e.g., pumping, inflow to pits). Water levels measured in a number of wells in the study area were used as specific calibration points, as was the baseflow of the Humboldt River.

Once a satisfactory steady-state calibration had been achieved, transient calibration was conducted to demonstrate the capability of the numerical model to replicate the response of the groundwater flow system to historical pumping from dewatering wells. As is normally the case, some additional refinement of the hydraulic parameters was conducted during transient calibration. Transient calibrations were conducted by simulating drawdowns in alluvial monitoring wells surrounding the mine pit.

A sensitivity analysis was conducted to assess which of the model input parameters might have the greatest effect on predictions made with the model. The primary purpose of such an analysis is to identify those parameters that should be the focus of continuing investigations in order to minimize the uncertainty associated with model predictions.

## PREDICTIVE SIMULATIONS OF GROUNDWATER DRAWDOWN AND RECOVERY

After calibration had been completed, the effects of dewatering the Lone Tree Mine pit through the end of year 2006 were simulated. Based on predictive simulations using the calibrated numerical model, the amount of water that will have to be managed through a combination of pumping from wells and sumps in the pit will range from about 44,000 gallons per minute (gpm) in 1995 to about 75,000 gpm in 2006. The maximum extent of the 10-foot drawdown isopleth resulting from dewatering and pit infilling for the Proposed Action would occur in year 2036, about 30 years after mining is completed. The groundwater drawdown area greater than 10 feet in depth would extend in a generally circular pattern approximately 5 to 7.5 miles from the Lone Tree pit.

The numerical model was also used to predict the rate at which the Lone Tree Mine pit would fill with groundwater at the end of year 2006 when the dewatering system is turned off. The initial rate of recovery is relatively rapid, followed by decreasing rates as hydraulic gradients into the pit diminish. For the Proposed Action, the water table in the pit is predicted to recover to approximately 90 percent of the pre-mining water level about 23 years after dewatering ceases, and then will continue to approach the pre-mining water level asymptotically. The pit lake probably would reach hydraulic steady-state conditions nearly 100 years after pit infilling begins.

In addition to declines in the water table resulting from mine dewatering and pit infilling, the model was used to predict the potential effects on springs and seeps and relative changes in baseflow in the Humboldt River. After mining and dewatering cease and pit infilling occurs, flow in the Humboldt River will decrease by as much as 0.45 cfs. The maximum decrease in flow in the Humboldt River due to pit infilling is expected to occur in year 2033, after which there would be a gradual return to pre-mining surface water flow. The model also predicts that flow in several springs and seeps could be influenced by dewatering.

## REVISED PREDICTION OF NATURE AND RATE OF PIT LAKE INFILLING

Since completion of the DEIS, HCI has recalibrated the groundwater flow model (*MINEDW*) using more recent dewatering scenarios and updated pit plans (HCI 1996a, 1996b). The primary purpose of rerunning the model was to estimate inflow rates and to identify the sources of groundwater that will comprise the pit lake after mine dewatering ceases at the Lone Tree Mine. This information was used by PTI (1996) in its predictions of pit lake chemistry.

A three-step process was used by HCI in this most-recent modeling effort: (1) simulate dewatering and subsequent infilling of the Lone Tree pit in order to develop a water balance; (2) use of numerical particle tracking to determine the origin of water that fills the pit lake; and (3) use of particle tracking again to identify the location of potential outflow from the pit and the rate and extent of movement of that outflow in the adjacent groundwater flow system.

### Updated Dewatering and Infilling Model Results

As previously predicted with the hydrologic model, the initial rate of water level recovery in the pit would be relatively rapid, followed by a decreasing rate with time as the hydraulic gradients into the pit decrease. The model predicts that the elevation of the surface of the pit lake would recover to approximately 90 percent of the pre-mining static water level about 42 years after dewatering ceases; this compares with the earlier prediction of 23 years that was included in the DEIS. It is predicted that the pit would reach essentially hydraulic steady-state conditions approximately 162 years after infilling begins; the DEIS states that steady-state probably would be achieved in nearly 100 years.

Another aspect of the revised model prediction that was not included in the DEIS is that there would be outflow from the Lone Tree pit lake, even during the early stages of infilling. This early-time outflow is a consequence of the predicted pit lake water level recovering faster than the water table in the adjacent groundwater system. Most of the water flowing into the pit lake would be from the Wayne Zone. A "depression" would therefore be created in the water table immediately adjacent to the pit in early time, followed by filling of the depression and reestablishment of the more typical groundwater throughflow in later time resulting from re-establishment of the regional gradients.

### Quantifying Inflow to Pit Lake From Various Water Chemistry Zones

Six chemistry zones in the vicinity of the Lone Tree pit were categorized on the basis of water chemistry data from wells:

1) all bedrock and alluvium north and northeast of the pit extending past Treaty Hill;

2) Valmy Formation immediately north of the pit;

3) alluvium west of the pit extending past Brooks Spring;

4) Havallah Formation to the southwest of the pit;

5) alluvium and all bedrock east, southeast, and south of the pit extending past the town of Valmy; and

6) the Wayne Zone (primary structural zone in bedrock in the pit area).

Amounts of groundwater flowing into the pit lake from each of the water chemistry zones were calculated using a particle tracking subroutine included in *FEMCAD*, HCI's pre/post-processor for the finite element groundwater flow codes. Results indicate that groundwater comprising the Lone Tree pit lake will originate essentially from only three of the six water chemistry zones -- Valmy Formation (5%), Havallah Formation (30%), and the Wayne Zone (65%).

## Simulation of Outflow from the Pit Lake

The particle tracking method described above was also utilized to predict the location, rate, and extent of outflow from the pit lake due to groundwater throughflow. As the pit lake fills, the particles were tracked by *FEMCAD* as they moved away from the pit and into the surrounding groundwater system. The model predicts that there will be outflow from the pit lake, even during the early stages of infilling, because the pit lake would recover faster than the water table in the adjacent groundwater system as a result of relatively large amounts of direct inflow into the pit from the Wayne Zone. This will create a "depression" in the water table immediately adjacent to the pit in early time.

During the initial stages of pit lake infilling, water moves relatively quickly through the fractured Valmy Formation. As the lake continues to fill, water from the bedrock moves into a groundwater "depression" in the alluvium. Since the alluvium has a relatively low permeability (hydraulic conductivity) and relatively large porosity, movement of particles in the alluvium is significantly reduced.

## REFERENCES

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Mitten, H.T., G.C. Lines, C. Berenbrock, and T.J. Durbin, 1988. Water Resources of Borrego Valley and Vicinity, San Diego County, California, Phase 2 Development of a Groundwater Flow Model. USGS Water Resources Investigation Report 87-4199, 27 pp.

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# APPENDIX I

(Factors of Safety for the
Lone Tree Mine Tailings Impoundment)

# APPENDIX I

## FACTORS OF SAFETY FOR THE LONE TREE MINE TAILINGS IMPOUNDMENT

To increase the tailings impoundment capacity under the Proposed Action, the height of the tailings embankment would be raised. The interior tailings dam embankment slope has been modified from 3H:1V to 2H:1V. The factor of safety for 2H:1V slopes vs. 3H:1V slopes is shown in **Table Appendix I-1** below.

**TABLE APPENDIX I-1**
**FACTORS OF SAFETY FOR LONE TREE TAILINGS IMPOUNDMENT**

| Interior Tailings Embankment Design | Static Factor-of-Safety | Pseudo-Static Factor-of-Safety |
|---|---|---|
| 3H:1V (Previous Condition) | | |
| ♦ "toe" failure surface | 1.4 | 1.1 |
| ♦ "deep circular" failure surface | 1.9 | 1.4 |
| 2H:1V (Existing & Proposed Action) | | |
| ♦ "toe" failure surface | 1.5 | 1.2 |
| ♦ "deep circular" failure surface | 2.8 | 1.5 |

Source: Welsh Engineering (1992); WESTEC (1995).

# APPENDIX J

(Information Supporting Alternative Water Disposal Studies
at the Lone Tree Mine)

# Santa Fe Pacific Gold Corporation

# Lone Tree Mine

## Summary of Alternative Water Management Evaluations For Mine Dewater

April 26, 1996

On November 29, 1995 the Nevada Division of Water Resources issued permit No. 59627 to Santa Fe Pacific Gold Corporation for the Lone Tree Mine ("LTM"). One of the conditions to Permit No. 59627 provides:

> The permittee will prepare a report outlining possible disposal alternatives for any dewater encountered but not consumed in the mining project. The report will specifically address the proposed methods of disposal, including injection wells, infiltration basins, substitution for existing rights and any further contemplated discharge to surface sources. This report must be submitted to the State Engineer no later than April 30, 1996.

(the "Permit Condition"). This report is submitted in response to the Permit Condition. LTM believes that efforts described in this report represent significant progress toward enhanced water management.

Open pit mine dewatering has been required at the LTM since 1991. Water table depression in the pit area is required to promote a safe and dry operating environment for both personnel and equipment. The average pumping rate for 1995 was 26,073 gallons per minute (gpm) creating 36 feet of average water table depression in the pit area during the year for a year-end, project-to-date drawdown of 330 feet below the original water surface. Mine dewater is currently discharged via pipelines and canals to the Humboldt River near Comus Gage. Water is pumped from the fractured bedrock aquifer that intersects the LTM pits.

The three specific methods of water management outlined in the Permit Condition are all under evaluation, each at a different stage of progress. Progress toward each method is discussed separately below.

## SUBSTITUTION

Substitution is the most likely of the three methods described in the Permit Condition to come to fruition. The three significant substitution options are Trenton Canyon, Marigold Mine

and Sierra Pacific Power Company ("SPPCo"). LTM will supply SFPG's new Trenton Canyon Project, located 13 miles to the southeast, via a booster pump station and buried 10-inch pipeline from LTM to a 300,000 gallon storage tank. The facilities for this project are 95% complete. The total cost of the facilities will be approximately $1,500,000. The NDWR has approved a temporary change in Place of Use for a portion of the LTM's consumptive use. Trenton Canyon will use 1100 gpm. SFPG will file an application to appropriate a portion of its unused mine dewater for Trenton Canyon life-of-mine use. The success of this substitution project is, of course, dependent on that application being approved.

The Lone Tree-Trenton Canyon Pipeline passes near the Marigold Mine. Preliminary discussions with Marigold have evolved into serious negotiation of an agreement for SFPG to provide Marigold Mine with water from LTM. The issues of concern in the negotiations are water quality, consistency of supply, maintenance of Marigold's existing water rights and well field, and mitigation of impacts, if any, on Marigold's water supply wells and monitoring wells caused by LTM pumping. SFPG hopes to present an agreement to you and the necessary applications to allow for Marigold substitution in the near future. The Lone Tree-Trenton Canyon Pipeline has been sized to provide Marigold water and accordingly substitution can begin promptly upon necessary NDWR approval. The Marigold Mine will use approximately 950 gpm.

SPPCo advised you by letter dated February 12, 1996 of the possibility that it will accept LTM substitution. This option is also proceeding toward reality. SPPCo and LTM personnel regularly sample the quality of the discharge water and a database has been compiled allowing detailed tracking of water chemistry fluctuations. Engineering design is progressing with alternative pipeline routes from the LTM discharge to the SPPCo facilities (see attached area map). Pump station design is in progress and pump selection has been completed. Permitting is progressing with LTM managing the pipeline rights-of-way issue. Construction costs for the project will be divided by LTM assuming responsibility for all pump equipment and piping while SPPCo will handle all electrical connections and pump control issues. SPPCo's main concerns center around a water source suitable for their process needs, the ability to maintain a continuous water source, and the preservation of existing water rights. SPPCo must be assured of an

operational water supply system in the event of problems with the LTM water supply. LTM expects to also file the necessary applications with NDWR to allow for SPPCo substitution in the near future. SPPCo will use approximately 3,000 gpm.

## INFILTRATION

LTM is presently conducting a nineteen-hole exploration program in four private-land sections. The project schedule is set forth on the attached schedule and as you can see, work might extend to federal lands as drill results are received and necessary regulatory hurdles are overcome. Drilling started later than LTM had expected due to water quality reconnaissance and program design. All holes are evaluated by means of geotechnical and geophysical logging. Six holes have been completed in Section 15 (see attached map). Initial indications are that potentially favorable sandy/silty alluvial deposits are present. Continuous-sample auger drilling is scheduled for the week of April 29, 1996 and will be used to refine the comparison of the piezometer holes with the electric logs. Samples from the auger drilling will be sent to a lab for sieve analysis, permeability testing and meteoric water mobility tests. This drilling project will allow collection of the correct data to determine favorably permeable locations for the construction of pilot rapid infiltration basins ("RIBs") and supply data for the permitting process of an operational infiltration system. The infiltration evaluation began in October 1995 and as you can see from the schedule, an important feasibility decision point comes after this next field season, in September, 1996. If pilot RIBs are determined to be feasible, the project schedule continues to June, 1997. It is too early to ascertain how much water can be managed by infiltration.

## INJECTION

The evaluation of injection wells as a means of returning water to the aquifer continues as data is collected as the infiltration exploration wells are completed in bedrock as monitor wells and as LTM's other monitor wells are constructed. Based on the data generated to date, the feasibility of injecting large volumes of water to the bedrock appears to be less favorable than the

infiltration option. Well locations that would accept large quantities of water have been difficult to target. The discrete structural zones that host the most productive wells are much less defined distal to the pit area due to sparse subsurface data. LTM is, however, in the process of obtaining a UIC permit for the Brooks Spring Users Well as an injection site for 40-80 gpm of mine dewater. While 40-80 gpm is not much water compared to total pumping rate, injection near Brook Springs should benefit that specific source. Due to the focus on substitution and infiltration options, further evaluation of a more general injection program was deferred. As you can see from the attached schedule, those efforts are scheduled to begin in June 1996 and is slated for completion in late 1998.

## SUMMARY

LTM has made significant process toward the substitution options. Barring some unforeseen permitting problem, LTM believes these substitution options will become a reality. LTM is aggressively working to determine the feasibility of an infiltration option but cannot offer conclusions about the amount of water that can be managed by infiltration. Injection options will also be aggressively evaluated over the next two years.

C:\RICHIE\0430RDH1.DOC

No. 59627

# APPLICATION FOR PERMIT
# TO APPROPRIATE THE PUBLIC WATERS OF THE STATE OF NEVADA

Date of filing in State Engineer's Office DEC 2 1 1993

Returned to applicant for correction

Corrected application filed

Map filed JAN 1 9 1994 under 59626

The applicant Lone Tree Mining, Inc.

P.O. Box 388 (Street and No. or P.O. Box No.), of Valmy (City or Town)

Nevada, 89438 (State and Zip Code No.), hereby make s application for permission to appropriate the public waters of the State of Nevada, as hereinafter stated. (If applicant is a corporation, give date and place of incorporation; if a copartnership or association, give names of members.) Delaware 2-21-90

1. The source of the proposed appropriation is Underground (Name of stream, lake, spring, underground or other source)

2. The amount of water applied for is 18.51 cfs second-feet (One second-foot equals 448.83 gals. per min.)

   (a) If stored in reservoir give number of acre-feet

3. The water to be used for Dewatering (Irrigation, power, mining, manufacturing, domestic, or other use. Must limit to one use.)

4. If use is for:

   (a) Irrigation, state number of acres to be irrigated

   (b) Stockwater, state number and kinds of animals to be watered

   (c) Other use (describe fully under No. 12. "Remarks" See No. 12

   (d) Power:

   (1) Horsepower developed

   (2) Point of return of water to stream

5. The water is to be diverted from its source at the following point NE¼ NE¼ of Section 11, T34N, R42E, or at a point from which the NE corner of said Section 11 bears N 44° 40' 13" E a distance of 946.95 ft. (Describe as being within a 40-acre subdivision of public survey, and by course and distance to a section corner. If on unsurveyed land, it should be so stated.)

6. Place of use Sections 1, 2, 11, 12, 13, 14, 15, 23, 24 T.34N, R.42E MDB&M (Describe by legal subdivision. If on unsurveyed land, it should be so stated.)

7. Use will begin about January 1 (Month and Day) and end about December 31 (Month and Day), of each year.

8. Description of proposed works. (Under the provisions of NRS 535.010 you may be required to submit plans and specifications of your diversion or storage works.) Well casing, pump and distribution system (State manner in which water is to be diverted, i.e. diversion structure, ditches and flumes, drilled well with pump and motor, etc.)

9. Estimated cost of works $500,000

10. Estimated time required to construct works Two Years
If well completed, describe works.

11. Estimated time required to complete the application of water to beneficial use Five years

12. Remarks: For use other than irrigation or stock watering, state number and type of units to be served or annual consumptive use:
This application is for mine dewatering at Lone Tree Mine. Accordingly, it is the intent of Lone Tree Mining, Inc. that any permit granted pursuant to this application will be related to Lone Tree Mining, Inc.'s other dewatering permits, including without limitation, Permit Nos. 56578-56586. It is the intent of Lone Tree Mining, Inc. that any permit granted hereunder shall be subject to the Rule Concerning Spacing Requirements in a portion of the Clovers Area Groundwater Basin (64) and the Pumpernickel Valley Groundwater Basin (65) and shall be used in accordance with the terms and conditions of that rule.

By s/Cynthia M. DeWeese
P.O. Box 388, Valmy, NV 89438

Compared bk/cmg cl/bk

Protested 4/5/94 by: Lander County; by: (4/7/94 Humboldt River Basin Water Authority

APPROVAL OF STATE ENGINEER

This is to certify that I have examined the foregoing application, and do hereby grant the same, subject to the following limitations and conditions:

This permit is issued subject to existing rights. It is understood that the amount of water herein granted is only a temporary allowance and that the final water right obtained under this permit will be dependent upon the amount of water actually placed to beneficial use. A totalizing meter must be installed and maintained in the discharge pipeline near the point of diversion and accurate measurements must be kept of water placed to beneficial use. The totalizing meter must be installed before any use of water begins or before the Proof of Completion of Work is filed.

This permit does not extend the permittee the right of ingress and egress on public, private or corporate lands.

The manner of use of water under this permit is by nature of its activity a temporary use and any application to change the manner of use granted under this permit will be subject to additional determination and evaluation with respect to the permanent effects on existing rights and the resource within the ground water basin. (CONTINUED ON PAGE 2)

The amount of water to be appropriated shall be limited to the amount which can be applied to beneficial use, and not to exceed 18.51 cubic feet per second

Work must be prosecuted with reasonable diligence and be completed on or before May 25, 1997

Proof of completion of work shall be filed before June 25, 1997

Application of water to beneficial use shall be filed on or before May 25, 1999

Proof of the application of water to beneficial use shall be filed on or before June 25, 1999

Map in support of proof of beneficial use shall be filed on or before N/A

Completion of work filed

Proof of beneficial use filed

Cultural map filed

Certificate No. Issued

IN TESTIMONY WHEREOF, I, R. MICHAEL TURNIPSEED, P.E. State Engineer of Nevada, have hereunto set my hand and the seal of my office, this 29th day of November A.D. 95

R Michael Turnipseed P.E.
State Engineer

(PERMIT TERMS CONTINUED)

The issuance of this permit does not waive the requirements that the permit holder obtain other permits from State, Federal and local agencies, and is specifically issued contingent upon approval by the Nevada Division of Environmental Protection of the dewatering project.

The total combined diversion rate of Permits 54759, 54760, 54761, 54763, 54764, 56406, 56407, 56578, 56579, 56580, 56581, 56582, 56583, 56584, 56585, 56586, 56951, 57103, 57104, 58385, 58550, 59243, 59244, 59245, 59246, 59247, 59248, 59249, 59250, 59251, 59627, 60288, 60289, 60290, 60291, 60292, 60293, 60294, 60295, 60296, 60297, 60298, 60300, 60301, 60302, 60303, 60685 and 61238-T will not exceed 41,000 gallons per minute or 91.35 cubic feet per second for mining, milling and dewatering purposes.

The total volume of water allowed to be diverted under the above mentioned permits and for the same purposes will not exceed 66,133.0 acre-feet annually.

The total combined consumptive duty for mining and milling purposes under the above permits and any changes of these permits will not exceed 3,144.0 acre-feet annually.

All water diverted but not used for mining or milling purposes will be discharged to the Iron Point Relief Canal via the aqueduct completed in June, 1993.

All water diverted will be measured and reported to the State Engineer on a monthly basis. The report will include the amount of water diverted from each well, the amount of water used for mining and milling purposes, and the amount discharged to the Iron Point Relief Canal. This report will be submitted to the State Engineer within 15 days of the last day of the preceding month.

This permit is issued subject to the "Lone Tree Mining, Inc. Unified Monitoring Plan", March 27, 1993.

The State Engineer will retain the right to require additional monitoring over and above the monitoring required in the monitoring plan mentioned and also will retain the right to seek other disposal options of water discharged to the Iron Point Relief Canal.

The permittee, on a schedule acceptable to the State Engineer, will prepare and present an update on the activities of the mine and the monitoring plan on a periodic basis, but not less than two times a year.

The permittee will prepare a report outlining possible disposal alternatives for any dewater encountered but not consumed in the mining project. The report will specifically address the proposed methods of disposal, including injection wells, infiltration basins, substitution for existing rights and any further contemplated discharge to surface sources. This report must be submitted to the State Engineer no later than April 30, 1996.

A "Stipulation to Withdraw Protest" was made and entered into by and between Santa Fe Pacific Gold Corporation, Lone Tree Mine and its successors, and Lander County on August 12, 1994. A second "Stipulation to Withdraw Protest" was made and entered into by and between Santa Fe Pacific Gold Corporation, Lone Tree Mine and its successors, and the Humboldt River Basin Water Authority in August, 1994. The State Engineer may not concur with and is not bound by the terms and conditions of these stipulations to withdraw protest, pursuant to NAC 533.150.

This permit also incorporates the provisions of Amended Order No. 1086, issued by the State Engineer on January 21, 1994.

Sierra Pacific
POWER COMPANY
Meeting your future with energy
6100 Neil Road, P.O. Box 10100, Reno, Nevada 89520-0400 • 702.689.4011

February 12, 1996

R. Michael Turnipseed, P.E.
Division of Water Resources
123 W. Nye Lane
Carson City, Nevada 89710

Dear Mr. Turnipseed:

Sierra Pacific Power Company (Sierra) and Lone Tree Mine have joined forces to implement a project that will conserve the groundwater resource in the Valmy/Lone Tree basins. The proposed project will pipe water from the Lone Tree Mine cooling pond to the Valmy Power Plant cooling towers. This project, when completed, will allow Sierra to rest their existing cooling water supply wells. Last week a joint meeting with Sierra and Lone Tree Mine was held at the Valmy Power Plant. The meeting was to identify issues toward construction and implementation of a water supply pipeline from Lone Tree to the power plant. Items discussed at the meeting are outlined below:

- Permitting and Environmental Issues
    - Right-of-ways
    - Cultural surveys
    - Water of the U.S. and of the State, 404 permit
    - Preservation of existing water rights
- Water Chemistry
    - Review existing data
    - Chemical Injection
- Design and Construction Issues
    - Design basis for pump station
    - Waterline
    - Possible extension to Hot Pots
    - Control philosophy
    - Power line
- Project Schedule
- Operational Issues
    - Cost sharing on pumping costs
    - Domestic well status

Prior to investing capital funds for this project, Sierra and Lone Tree would like written confirmation from your office confirming support for this project. Sierra would also like confirmation that Sierra's existing permitted and certificated water rights would remain intact during the period when Sierra would be using Lone Tree water for cooling purposes.

Please feel free to contact me if you have concerns or require additional information regarding this project.

Sincerely yours,

Bob Squires

Robert R. Squires, P.E.

cc: John Mansanti, P.E.
Lone Tree Mine Operations Manager

BOB MILLER
Governor

STATE OF NEVADA

PETER G. MORROS
Director

R. MICHAEL TURNIPSEED, P.E.
State Engineer

# DEPARTMENT OF CONSERVATION AND NATURAL RESOURCES

DIVISION OF WATER RESOURCES
Capitol Complex
123 W. Nye Lane
Carson City, Nevada 89710
(702) 687-4380

RE: 56406, 56407,
56951, 57103,
57104

April 21, 1993

R. D. Haddock
Assistant General Counsel
Santa Fe Pacific Minerals Corporation
250 S. Rock Boulevard, Suite 100
Reno, NV 89502

Dear Mr. Haddock:

This office has had an opportunity to review your letter dated April 8, 1993 regarding the injection test wells and the time necessary to complete the construction of the aqueduct to the Iron Point Relief Canal. Your letter also referenced a discussion of amending the language of Permits 56406, 56407, 56951, 57103, and 57104.

The flooding conditions of the Humboldt River and sloughs are recognized to be a problem as to certain phases of the aqueduct construction. Your letter states that construction of the aqueduct can be completed by May 30, 1993 and I will agree to allow continued discharge to the Herrin Slough until May 30, 1993.

The progress report regarding the monitoring/injection study recently conducted southwest of the Lone Tree Pit is appreciated. It is agreed that the area of interest is not feasible for disposal of significant quantities of excess mine water. However, I reserve the right and authority to require further study of disposal by injection under any future conditions or circumstances.

The amending of any language on the referenced permits will be put aside until the actual completion of the aqueduct and discharge of water to the Iron Point Relief Canal.

Very truly yours,

R. Michael Turnipseed, P.E.

R. Michael Turnipseed, P.E.
State Engineer

RMT/bl
cc: Tim Leftwich
Kenneth P. Pavlich
Wayne Testolin

HCI HYDROLOGIC CONSULTANTS, INC.

April 6, 1993 HCI-834

Mr. Jon Westfall
Dewatering Coordinator
Santa Fe Pacific Gold
Lone Tree Mine
P.O. Box 388
Valmy, NV 89438

SUBJECT: Hydrologic Testing of Piezometers M/O 19-1, M/O 21-2 and M/O 21-1 and Preliminary Evaluation of Disposal of Mine Water by Injection Wells

Dear Mr. Westfall:

A series of aquifer tests was recently completed by Hydrologic Consultants, Inc. (HCI) and Lone Tree Mine, Inc. (LTMI) to help evaluate the feasibility of using injection wells to dispose of mine water from the Lone Tree pit. This work is part of a more comprehensive ongoing investigation to evaluate the best method of disposing of mine water. LTMI selected three sites for hydraulic testing based on the potential of locating a favorable injection zone in the Havallah Formation to the southwest of the Lone Tree pit. At each site, a borehole was drilled and completed as nominal 2-inch diameter piezometer.

## INTRODUCTION

The three piezometers are completed in different structural settings within the saturated Havallah Formation, the most favorable hydrostratigraphic unit for injection of mine water based on current data. Piezometer M/O 19-1 was drilled and completed at the intersection of two faults. Piezometer M/O 21-2 was targeted to intercept a northeast trending structure that could have similar hydraulic characteristics to some of the structures in the pit area. Piezometer M/O 21-1 does not intercept any significant faults, but it is within an area of structural complexity.

## AQUIFER TEST METHODS

The different sites were evaluated by conducting aquifer tests to estimate the transmissivity and specific capacity for each of the piezometers. Aquifer tests in piezometers M/O 21-2 and M/O 21-1 were conducted on March 12, 1993 using a constant head test (Ferris et al., 1962). Piezometer M/O 19-1 was tested on March 30, 1993 using a constant recharge method. Both of these methods are equally valid for testing the aquifer in these piezometers. The reason for using different aquifer testing methods was because the same pumping equipment was not available for each test.

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Ferris et al. (1962) describe a method for estimating transmissivity and coefficient of storage from a aquifer test in which the water level is maintained constant and the pumping rate varies with time. The transmissivity can be calculated by plotting arithmetic values of $s_w/Q$ against logarithmic values of $t/r_w^2$, and using the equation

$$T = \frac{264}{\Delta(s_w/Q)} \tag{1}$$

where

$T$ = transmissivity [gallons per day/ft (gpd/ft)],
$s_w$ = pumping water level [ft],
$Q$ = pumping rate [gallons per minute (gpm)],
$t$ = time after pumping started [min],
$r_w$ = radius of well [ft], and
$\Delta$ = change per log cycle.

Similarly, estimates of transmissivity were also made using the Jacob solution (Ferris et al., 1962). The Jacob solution differs from the constant head method in that the pumping rate is held constant and the change in water level varies with time. The Jacob solution is

$$T = \frac{264Q}{\Delta s} \tag{2}$$

where $s$ is the pumping/injection water level [ft].

## AQUIFER TESTS

All of the aquifer tests were completed by pumping water into the piezometers. Pump-in methods were used because the piezometers have a small diameters and deep static water levels that do not accommodate a pump capable of introducing a measurable stress on the aquifer system. Water was injected into the piezometers at a rate of 70 to 80 gallons per minute (gpm), which was the maximum capacity of the injection equipment. Water levels in the wells were measured with a pressure transducer and pumping rates were measured with a flow meter.

Data collected from the aquifer tests were evaluated using the methods described above. The transmissivity of the aquifer and the specific capacity of the piezometers were calculated and are tabulated in Table 1. The specific capacity is the rate of pumping/injection (gpm) divided by the change in water level (ft) in a piezometer/well. The units of specific capacity are gpm/ft,

and represents the rate of pumping/injection that will lower raise the water level in the well one foot. The specific capacity or transmissivity can be used to make a preliminary estimate of the maximum rate that water could be injected into a well completed in a aquifer of similar hydraulic characteristics.

Aquifer Test Results

Results of the three aquifer tests indicate that the hydraulic characteristics of the aquifer are significantly different for each piezometer. Piezometer M/O 21-2, completed in a northeast trending fault, had the largest transmissivity and specific capacity. The actual transmissivity and specific capacity could not be estimated because the aquifer, at the location of piezometer M/O 21-2, is capable of receiving water at a greater rate than the injection equipment could pump. Piezometer M/O 19-1, completed at the intersection of two faults, has a transmissivity of 1,300 gpd/ft and a specific capacity of 0.5 gpm/ft. The transmissivity and specific capacity of piezometer M/O 19-1 is representative of an aquifer that is relatively tight. A well completed in the same hydrogeologic environment as M/O 19-1 would only be capable of achieving injection rates of 300 to 400 gpm using gravity flow. Piezometer M/O 21-1, not completed in a fault, had the lowest transmissivity and specific capacity of the three piezometers. The transmissivity in piezometer M/O 21-1 was estimated to be 300 gpd/ft and the specific capacity is 0.5 gpm/ft. An injection well completed in a similar hydrogeologic environment, would be capable of injecting water at rates of 150 to 250 gpm using gravity flow.

CONCLUSIONS

The results of the preliminary aquifer tests indicate that the Havallah Formation is not suitable for disposal of large quantities of mine water, in the vicinity of the three test piezometers. Some of the faults in the area of the test piezometers are areas of enhanced transmissivity, which might be capable of receiving significant quantities of water. However, the permeable faults are difficult to locate and represent a very small percentage of the aquifer. The majority of the aquifer in this area is not faulted, therefore, the area is not suitable for water injection.

No attempt was made in this study to design or evaluate an actual well field or assess the actual injection rate of an individual well. However, a simple extrapolation of the injection test data indicate that approximately three wells might have to be completed to attain a disposal rate of 2,000 to 3,000 gpm.

HCI is also concerned with recirculation of injected water since water injected into permeable faults could move rapidly downgradient to the pit. Evidence to support good hydraulic connection between the piezometers and the pit is the relatively rapid decline of water levels

(0.46 ft/week during the month of March) in the test piezometers constructed southwest of the pit. The relatively large and uniform decline in water levels in the test piezometers could be the result of a compartmentalized aquifer that is in good hydraulic connection to the aquifer in the area of the pit. If the aquifer is compartmentalized in this manner, water injected into the area of the test piezometers, could readily recirculate to the pit.

It appears that underground injection of mine water might not be feasible in the vicinity of the Lone Tree Mine. It is HCI's experience that ore deposits are often areas of that have anomalously large water producing capabilities. The anomalous hydrologic properties are likely associated with the same structures that localized the movement of ore-bearing fluids. Thus, a comparable hydrologic setting for water injection in an area adjacent to the mine might not exist.

If you have any questions concerning this letter, please contact us.

Sincerely,

HYDROLOGIC CONSULTANTS, INC.

Thom Hanna

Thomas M. Hanna
Senior Project Hydrogeologist

Lee C. Atkinson

Lee C. Atkinson, Ph.D.
President

TMH/LCA:cg

cc: Richie Haddock

Attachment: Table 1 - Aquifer Test Results

## REFERENCES

Ferris, J.G., Knowles, R.H., Brown, R.H., and Stallman, R.W., 1962, Theory of aquifer tests: U.S. Geological Survey, Water-Supply Paper 1536-E, 174 p.

TABLE 1

AQUIFER TEST RESULTS

| Piezometer | Transmissivity (gal per day/ft) | Specific Capacity (gal per min/ft) | Depth to Water on March 31, 1993 (ft) |
|---|---|---|---|
| M/O 19-1 | 1,300 | 0.8 | 564.5 |
| M/O 21-1 | 300 | 0.5 | 327.8 |
| M/O 21-2 | >2,000 | >1.0 | 267.8 |

HCI HYDROLOGIC CONSULTANTS, INC.

TECHNICAL MEMORANDUM

TO: Jon Westfall - Lone Tree Mine
Mark Ward - Lone Tree Mine
Richie Haddock - Santa Fe Pacific Gold, Reno

HCI-834

FROM: Thomas M. Hanna
Holly Van Buren
Lee C. Atkinson

DATE: August 20, 1993

SUBJECT: Infiltration Testing in Section 18 and Preliminary Estimates of Infiltration Rates

This technical memorandum describes the work recently completed by Hydrologic Consultants, Inc. (HCI) to assess the infiltration capacity of the shallow alluvium in the vicinity of Santa Fe Pacific Gold's (SFPG) Lone Tree Mine (LTM). HCI's work included 1) digging and logging of test pits, 2) conducting infiltration tests in the test pits, 3) analyzing the infiltration test data, and 4) estimating rates of infiltration and sizes of ponds for a potential mine water disposal system utilizing infiltration ponds.

## TEST PIT CONSTRUCTION

The location of the test pits was selected by SFPG to further evaluate mine water infiltration strategies previously proposed by Marigold Mining Company, Inc. prior SFPG's acquisition of the Stonehouse property. The test pits are located in Section 18 of Township 34 North, Range 43 East, on the east side of Lone Tree Hill approximately 1 mile east of the Lone Tree Pit (Figure 1).

The test pits were constructed on July 29, 1993 by digging 5 x 5 x 5 feet pits with a tractor-mounted backhoe. After the pits were dug, the bottom of the pits were squared by hand to assure that the area of each pit floor was 25 $ft^2$. The pit walls were then lined with plastic to reduce the lateral flow of ground water into the soils.

## DESCRIPTION OF TEST PIT SOILS

The test pits were excavated into three different soil types as defined by the U.S. Soil Conservation Service (SCS, 1992). Test pits 1, 2, and 5 were completed into the Broyles Alluvium, consisting of a very fine sandy loam. Test pit 3 was completed into the Prida-Sonoma Alluvium, a silty clay loam. Test pit 4 is in the Whirlo-Oxcorel-Weso soil, a very fine sandy loam (SCS, 1992). Appendix A contains the complete SCS soil descriptions.

After each test pit was dug, the soils were described in the field. Each test pit was completed in a similar soil type that was indistinguishable by visual observation in the field. The soils in each of the test pits consisted of an upper four feet of silty loess underlain by a relatively hard sandy gravel unit that comprised the bottom of the pits.

The following is a field description of the soils in the test pits:

- The upper four feet of the soils consists of ML with 5 percent fine to coarse gravel and 10 percent medium-grained sand. The sand and gravel are tan, angular, soft, poorly indurated, homogeneous, and consist of angular to sub-angular argillite, chert, and quartzite fragments. Minor sloughing occurs in pit walls.

- The bottom 1 foot of pits is comprised of SM with 20 percent coarse gravel and 20 percent coarse-grained sand. The sand and gravel are brown, firm to hard, well indurated, homogenous, and consist of angular quartzite, chert, and argillite.

## INFILTRATION TESTS

The infiltration tests were conducted by filling the pits with water and maintaining a constant water level in the pits for the entire duration of the tests while measuring the amount of water needed to maintain the water level. Each test pit was filled with approximately 3.5 feet of water, and the water level was monitored with a staff gage placed in the pit. The water level was maintained by letting the level in the pit drop by 0.1 foot and then refilling the pit to the original water level. As water was pumped into the pit, the volume was monitored with a flow meter and recorded. The time for each 0.1 foot drop in the water level to occur was recorded, and the infiltration rate was calculated from a simple volume/time relationship. Each test was conducted for a period of approximately three hours.

There is no exact method that can be used to estimate the hydraulic conductivity in soils of coarse gravel with matrices of finer material. However, a method -- the so-called "test pit method" -- outlined in the U.S. Bureau of Reclamation's *Drainage Manual* (USBR, 1978) describes a method that is considered sufficiently accurate to give reasonable hydraulic conductivities when applied to field problems.

The USBR (1978) uses the following equation to compute the hydraulic conductivity of soils that are unsaturated:

$$K = \frac{1{,}440\ Q}{CaD} \tag{1}$$

where:

$K$ = hydraulic conductivity (feet/day),
$a$ = side dimension of square pit (feet),
$Q$ = quantity of flow per unit of time ($ft^3$/min),
$D$ = depth of water maintained in test pit (feet), and
$C$ = conductivity coefficient based on the ratio $D/a$ (dimensionless).

Since the ratio $D/a$ for this field problem was less than the lowest value presented in Table 1, a conductivity coefficient was estimated. The estimate was made by plotting (Figure 2) the data from Table 1 and, after using linear regression, extrapolating to a $D/a$ value of 0.7.

## FINDINGS

The infiltration rate versus time was plotted for each test pit (Figures 3 through 7) to observe how the infiltration rates changed with time and to make sure that the infiltration rates had stabilized so that a nominal constant flow rate could be determined for use in Equation 1. It was found that in each of the tests that the infiltration rates decreased during the first hour and then stabilized after approximately 60 to 100 minutes.

Estimates of hydraulic conductivity calculated from the test pit method using the stabilized infiltration rates and Equation 1 ranged from 1.9 to 4.4 ft/day (Table 2). Test pits 2, 4, and 5 exhibited the largest hydraulic conductivities which ranged from 3.9 to 4.9 ft/day. Test pit 1 exhibited a hydraulic conductivity of approximately 3.5 feet/day; and test pit 3, which was constructed near an ephemeral drainage, had the lowest hydraulic conductivity of 1.9 ft/day. Pit 3 also retained nearly 2 feet of water 15 hours after the infiltration tests were completed, while all other test pits were dry after an equal time period.

HCI HYDROLOGIC CONSULTANTS, INC.

## ESTIMATES OF INFILTRATION POND SIZE

Based on the data gathered from the field infiltration tests and HCI's experience with large-scale infiltration systems in Nevada, preliminary estimates of sizes of potential infiltration ponds in the alluvium underlying Section 18 were made. The estimates of infiltration rates were made using an analytical solution developed by Scott and Aron (1967) that describes the infiltration of water from a trench in which the wetting front moves as plug flow:

$$V = 2\left[K_e S p\,(p+h)\,H\,(t-t_1)\right]^{1/2} - 2Sp\,\{[(p+h)\ln(2p/b)]/\pi - p\} \tag{2}$$

where

$$t_1 = \ln(2p/b)\,Sp/K_e \tag{3}$$

is the time after which flow from the trench becomes essentially radial, and

$V$ = cumulative recharge volume per unit length of trench at any time ($ft^3/ft$),
$K_e$ = effective hydraulic conductivity (ft/day),
$S$ = specific yield (dimensionless),
$p$ = thickness of unsaturated alluvium beneath trench (ft),
$h$ = thickness of saturated alluvium beneath trench (ft),
$H$ = depth to original water table (ft),
$t$ = time (days), and
$b$ = width of trench (ft).

Until site-specific data for potential infiltration pond sites are available for the thickness of the alluvium (both saturated and unsaturated), any estimates of infiltration are highly speculative. For the purposes of this preliminary evaluation, HCI has used the following input to Equations 2 and 3:

| | |
|---|---|
| $K_e$ = 3.1 ft/day, | $S$ = 0.2, |
| $p$ = 40 ft, | $h$ = 100 ft, |
| $H$ = 50 ft, and | $b$ = 300 ft. |

Using Equation 3, it can be estimated that the time for essentially radial flow from the trench to become established is about 3.4 days for $K_e$ = 3.1 ft/day (the geometric mean of the hydraulic conductivities from the infiltration tests). With Equation 2, the cumulative recharge volume per unit length of a 300-ft wide trench can then be estimated at any time after radial flow

is established. The average instantaneous infiltration rate per unit length (in gpm/ft) between any two time periods is simply the difference in the cumulative volumes divided by the length of the time period. Finally, the length of trench necessary to infiltrate 1,000 gpm -- a strictly arbitrary reference value -- can be estimated by dividing 1,000 gpm by the instantaneous infiltration rate per unit length. These results are shown in Table 3.

Based on the infiltration rates that decrease with time as estimated by Equation 2, infiltration into the alluvium underlying Section 18 would require approximately 8,000 (at the end of one year) to 19,500 lineal feet (at the end of five years) of infiltration ponds 300 feet wide, or approximately 2,400,000 to 5,850,000 $ft^2$ (55 to 134 ac) of surface area, to dispose of 1,000 gpm of water.

This estimate of infiltration capacity does not account for evaporation which is approximately 55 inches per year (pan evaporation) at nearby Battle Mountain (Farnsworth and Thompson, 1982). The actual evaporation from a lake surface will be lower than the pan rate due to the cooling effects of a larger volume of water. Conversely, the wave action of a lake can increase the actual evaporation rate relative to the pan rate. The net or effective evaporation rate probably ranges from 75 to 90 percent of the pan rate. Consequently, the total evaporation from 2,400,000 to 5,850,000 $ft^2$ of pond surface area could be approximately 120 to 350 gpm.

## CONCLUSIONS

The field tests recently completed in Section 18 indicate that the hydraulic conductivity of the shallow alluvial soils in that area is approximately the same to slightly less than that of similar soils at other locations in north-central Nevada. However, it should be recognized that the results from the test pits to the east of Lone Tree Hill reflect the shallow alluvium and might not reflect the infiltration capacity of deeper infiltration pits completed in Section 18 that might penetrate materials with significantly different hydraulic properties.

Although the apparent hydraulic conductivity of the soils is relatively high, the shallow depth to the water table limits the driving head and lateral extent of the mound that would be able to develop under an infiltration pond. This severely limits the infiltration capacity compared to areas that have similar hydraulic characteristics, but a deeper water table. Furthermore, the infiltration capacity of the pits will most likely decrease with time as a result of siltation and bio-fowling.

Because of the relatively large pond surface areas required, evaporative losses could comprise from 12 to 35 percent of the water put into the ponds. This raises a critical question regarding the efficacy of using infiltration ponds to dispose of mine water from the Lone Tree Pit since the evaporative loss would be a consumptive, but non-beneficial use of water.

______, 1996b. Updated Conceptual Hydrogeologic Model and Dewatering Estimates for Lone Tree Pit. Prepared for Santa Fe Pacific Gold Corporation, Valmy, Nevada. May 1996. HCI-834.

Mitten, H.T., G.C. Lines, C. Berenbrock, and T.J. Durbin, 1988. Water Resources of Borrego Valley and Vicinity, San Diego County, California, Phase 2 Development of a Groundwater Flow Model. USGS Water Resources Investigation Report 87-4199, 27 pp.

PTI Environmental Services (PTI), 1996. Revised Prediction of Water Quality in the Lone Tree Mine Pit Lake. Prepared for Santa Fe Pacific Gold Corporation, Valmy, Nevada. July 1996.

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## REFERENCES

Farnsworth, R.K., and Thompson, E.S., 1982, Mean monthly, seasonal, and annual pan evaporation for the United States: NOAA Technical Report

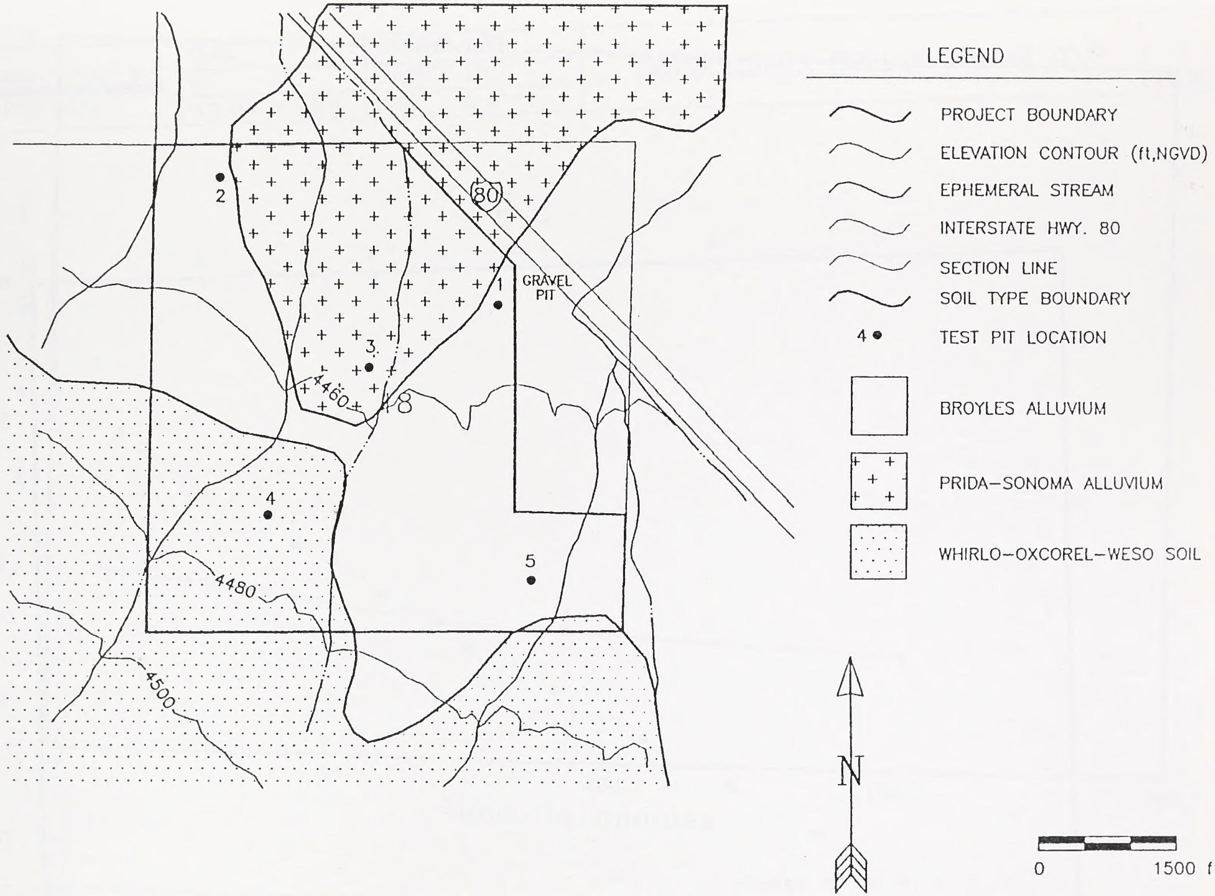
Scott, V.H., and Aron, G., 1967, Aquifer recharge efficiency of wells and trenches: Groundwater, vol. 5, no. 3, pp. 6-15.

U.S. Bureau of Reclamation, 1978, Drainage manual, 286 pp.

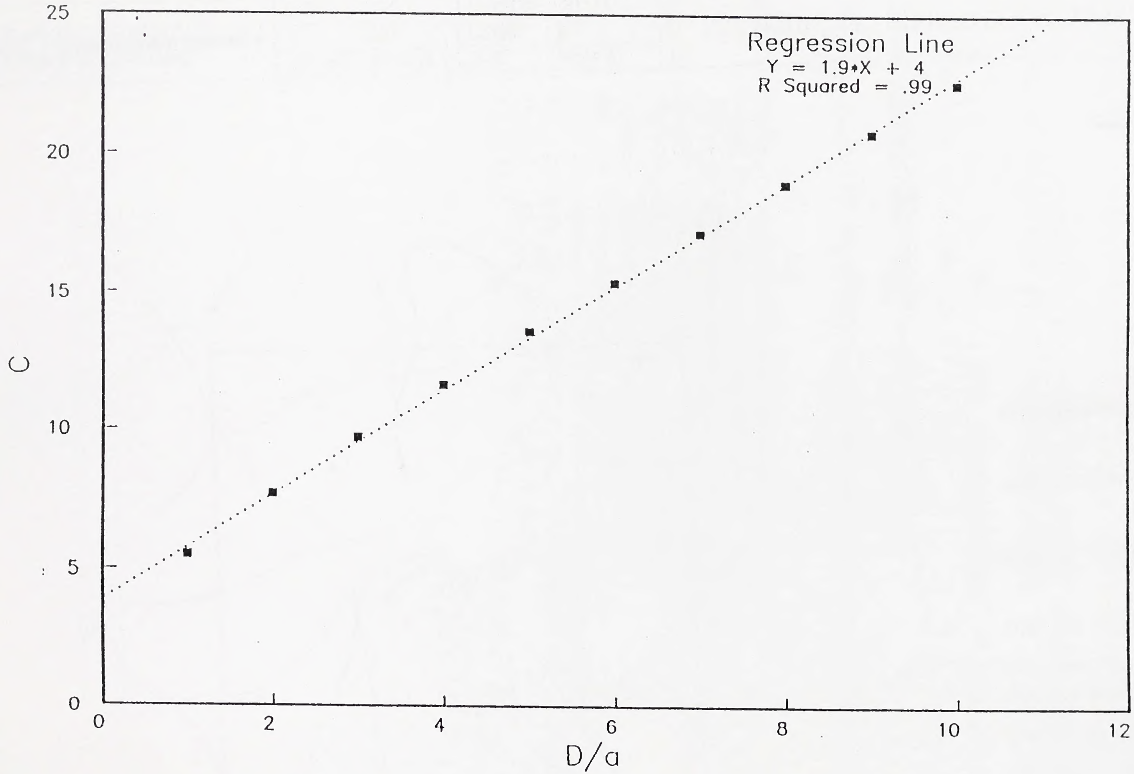
U.S. Soil Conservation Service, 1985, Soil survey of Lander County, Nevada, north part, vol. 1

Attachments: Figure 1 - Location of Infiltration Test Pits
Figure 2 - Conductivity Coefficient vs *D/a*
Figure 3 - Infiltration Rate vs Time, Test Pit #1
Figure 4 - Infiltration Rate vs Time, Test Pit #2
Figure 5 - Infiltration Rate vs Time, Test Pit #3
Figure 6 - Infiltration Rate vs Time, Test Pit #4
Figure 7 - Infiltration Rate vs Time, Test Pit #5
Table 1 - Values of Conductivity Coefficient Used in Equation 1
Table 2 - Estimates of Hydraulic Conductivity from Test Pits
Table 3 - Estimates of Infiltration Rates in Ponds
Appendix A - Detailed Description of Soils in Vicinity of Lone Tree Mine

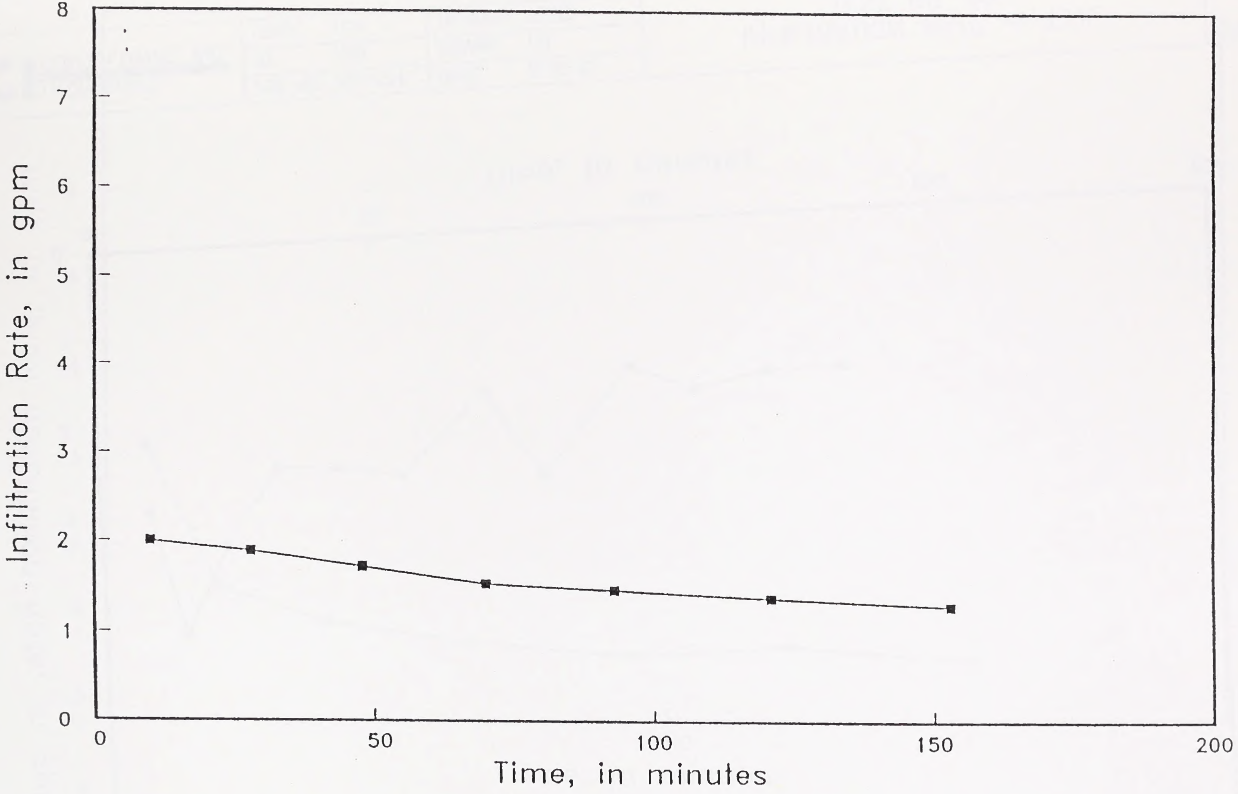
(Appendix A not included in this Lone Tree Mine Expansion FEIS)




| | | | |
|---|---|---|---|
| HCI HYDROLOGIC CONSULTANTS, INC. | JOB NO: HCI-834 | DATE: 8-4-93 | LOCATION OF INFILTRATION TEST PITS |
| | BY: HVB | DRAWN: PD | FIGURE: 1 |
| | CHKD: LCA | DRAWING: SH-EAST | |

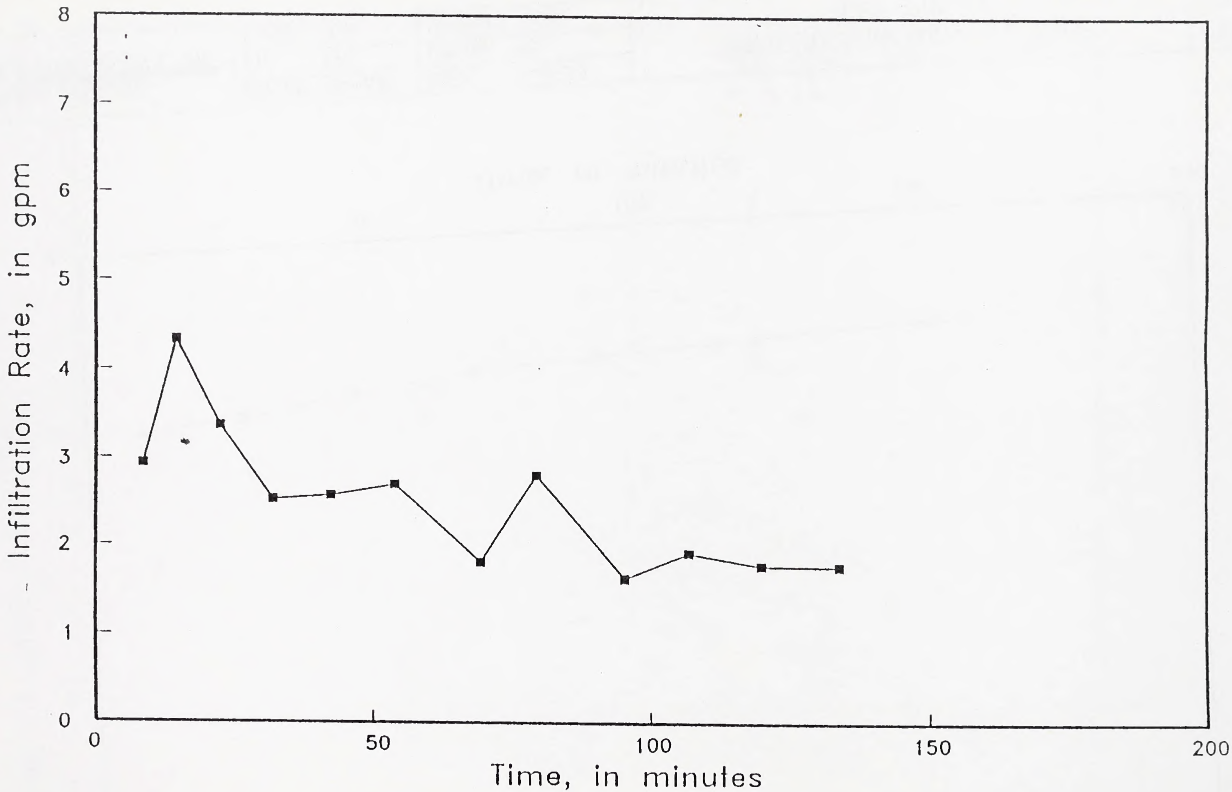



| HCI HYDROLOGIC CONSULTANTS, INC. | JOB NO: HCI-834 | DATE: 8-9-93 | CONDUCTIVITY COEFFICIENT vs D/a | FIGURE: 2 |
|---|---|---|---|---|
| | BY: HVB | DRAWN: PD | | |
| | CHKD: LCA | DRAWING: COEF | | |



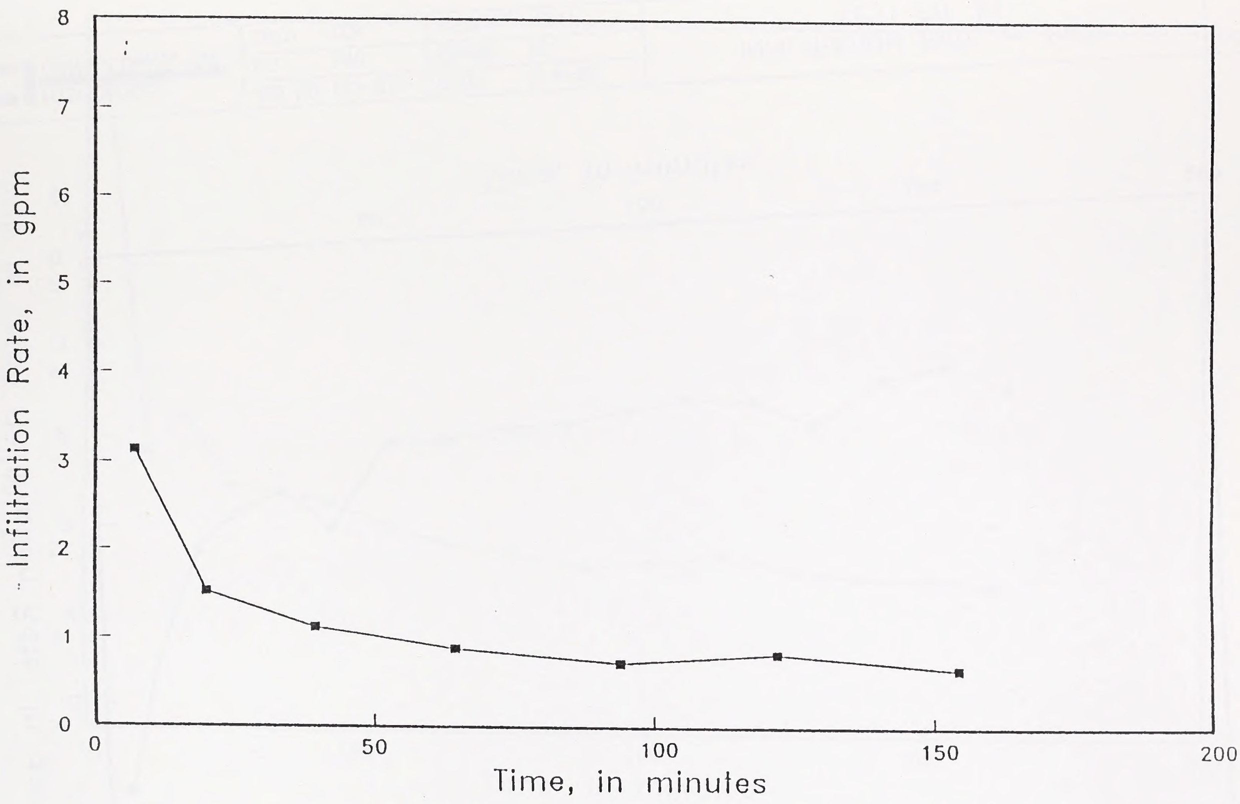

| | | | |
|---|---|---|---|
| HCI HYDROLOGIC CONSULTANTS, INC. | JOB NO: HCI-834 | DATE: 8-4-93 | INFILTRATION RATE vs TIME<br>TEST PIT #1 |
| | BY: HVB | DRAWN: PD | |
| | CHKD: LCA | DRAWING: TEST1 | |

FIGURE: 3

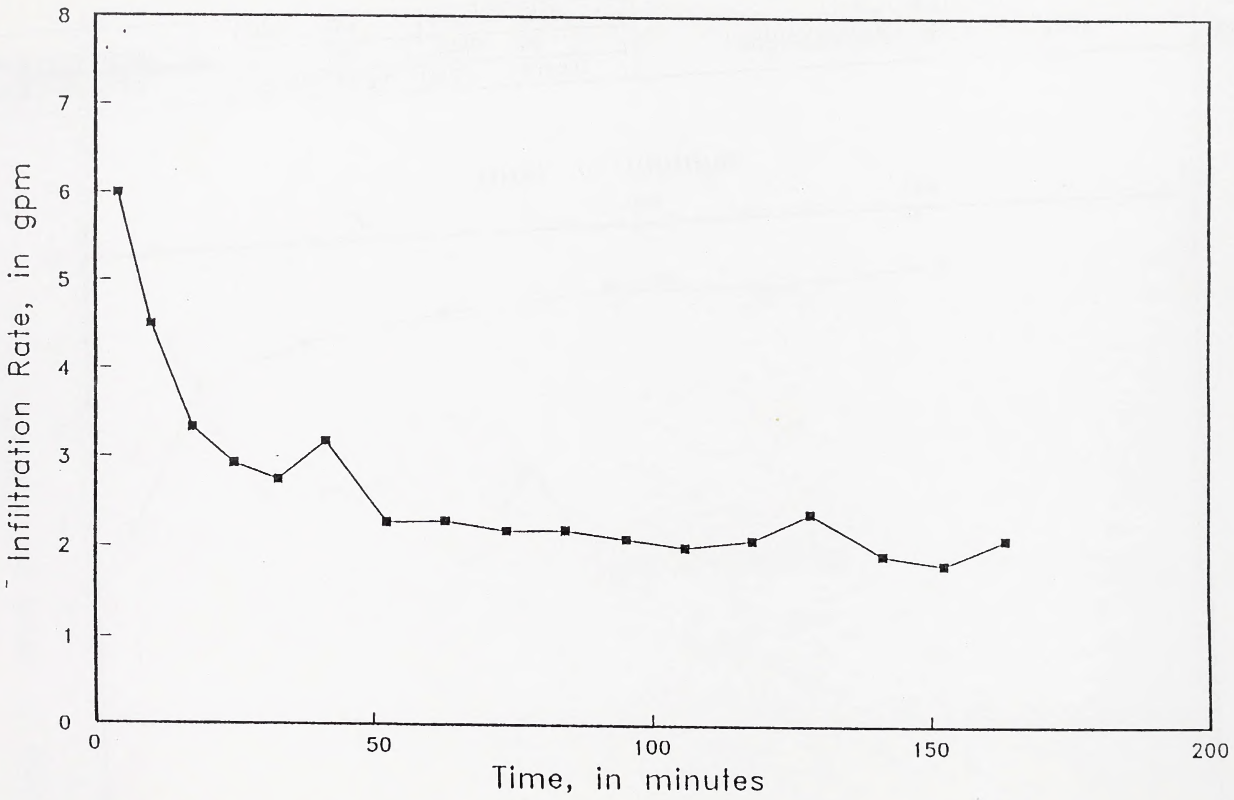



| | | | |
|---|---|---|---|
| HCI HYDROLOGIC CONSULTANTS, INC. | JOB NO: HCI-834 | DATE: 8-4-93 | INFILTRATION RATE vs TIME<br>TEST PIT #2 |
| | BY: HVB | DRAWN: PD | |
| | CHKD: LCA | DRAWING: TEST2 | |

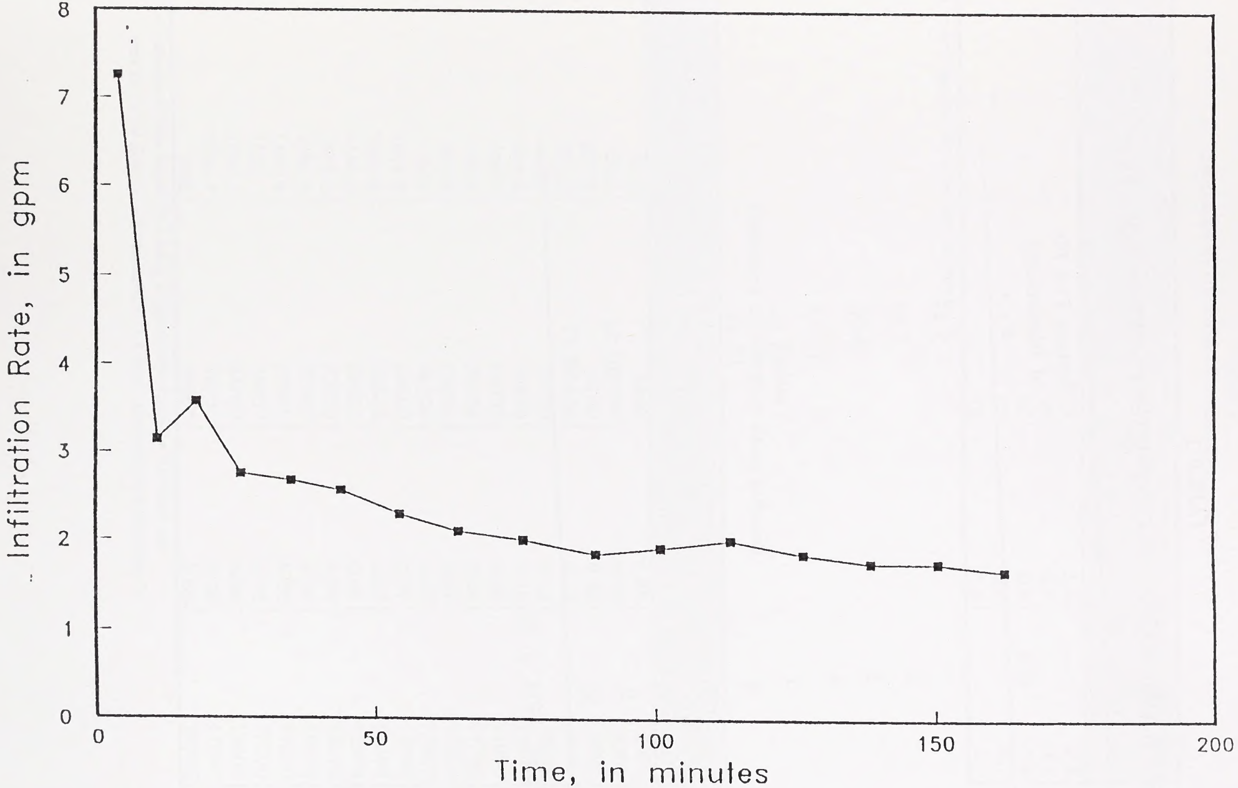
FIGURE: 4




| | | | |
|---|---|---|---|
| HCI HYDROLOGIC CONSULTANTS, INC. | JOB NO: HCI-834 | DATE: 8-4-93 | INFILTRATION RATE vs TIME TEST PIT #3 |
| | BY: HVB | DRAWN: PD | FIGURE: 5 |
| | CHKD: LCA | DRAWING: TEST3 | |




| | | | | |
|---|---|---|---|---|
| HCI HYDROLOGIC CONSULTANTS, INC. | JOB NO: HCI-834 | DATE: 8-4-93 | INFILTRATION RATE vs TIME TEST PIT #4 | FIGURE: 6 |
| | BY: HVB | DRAWN: PD | | |
| | CHKD: LCA | DRAWING: TEST4 | | |




| HCI HYDROLOGIC CONSULTANTS, INC. | JOB NO: HCI-834 | DATE: 8-4-93 | INFILTRATION RATE vs TIME<br>TEST PIT #5 | FIGURE: 7 |
|---|---|---|---|---|
| | BY: HVB | DRAWN: PD | | |
| | CHKD: LCA | DRAWING: TEST5 | | |

TABLE 1

VALUES OF CONDUCTIVITY COEFFICIENT USED IN EQUATION 1

| *D/a* | Square Test Pit of Dimensions *a* x *a* |
|---|---|
| 1 | 5.49 |
| 2 | 7.68 |
| 3 | 9.70 |
| 4 | 11.63 |
| 5 | 13.54 |
| 6 | 15.33 |
| 7 | 17.15 |
| 8 | 18.95 |
| 9 | 20.74 |
| 10 | 22.51 |

Reference: USBR, 1978, p. 95.

## Table 2
Estimates of Hydraulic Conductivity from Test Pits

| Test Pit | Time (1) (min) | Average Infiltration Rate (gpm) | Hydraulic Conductivity (ft/day) |
|---|---|---|---|
| 1 | 22 | 1.6 | 3.5 |
| 2 | 15 | 2.0 | 4.2 |
| 3 | 30 | 0.9 | 1.9 |
| 4 | 11 | 2.2 | 4.4 |
| 5 | 12 | 1.9 | 3.9 |

1 – Average time for water level to drop 0.1 ft.

## Table 3
Estimates of Infiltration Rates in Ponds

| Time (days) | Cumulative Infiltration Volume (1) (cubic ft/ft) | Infitration Rate (gpm/ft) | Length of Pond (ft/1000 gpm) |
|---|---|---|---|
| 91.3 | 8800 | 0.50 | 2000 |
| 182.6 | 12100 | 0.19 | 5300 |
| 273.9 | 14700 | 0.15 | 6800 |
| 365.2 | 16800 | 0.12 | 8400 |
| 456.5 | 18700 | 0.11 | 9200 |
| 547.8 | 20400 | 0.10 | 10300 |
| 639.1 | 22000 | 0.09 | 11000 |
| 730.4 | 23500 | 0.09 | 11700 |
| 821.7 | 24800 | 0.07 | 13500 |
| 913 | 26100 | 0.07 | 13500 |
| 1004.3 | 27300 | 0.07 | 14600 |
| 1095.6 | 28500 | 0.07 | 14600 |
| 1186.9 | 29600 | 0.06 | 16000 |
| 1278.2 | 30700 | 0.06 | 16000 |
| 1369.5 | 31800 | 0.06 | 16000 |
| 1460.8 | 32800 | 0.06 | 17600 |
| 1552.1 | 33800 | 0.06 | 17600 |
| 1643.4 | 34700 | 0.05 | 19500 |
| 1734.7 | 35700 | 0.06 | 17600 |
| 1826 | 36600 | 0.05 | 19500 |

1 – Calculated from Equation 2 using K (geometric mean) = 3.1 ft/day and time for radial flow to be established of 3.4 days, calculated from Equation 3.

# APPENDIX K

(Supporting Information on Potential Impacts to Fisheries and Aquatics in the Humboldt River as a Result of the Lone Tree Mine Discharge)

## APPENDIX K
## Supporting Information on Potential Impacts to Fisheries and Aquatics; by Mr. Michael J. Mitchell, Senior Aquatic Biologist, Queen of the River Fish Co.

## INTRODUCTION

Aquatic monitoring was conducted on the Humboldt River during 1995 at nine stations located both upstream and downstream of the site where Lone Tree Mine dewatering discharge enters the river. This monitoring was conducted by Queen of the River Fish Company, Inc. (Mr. Michael J. Mitchell; Longmont, Colorado). The monitoring program included descriptions of physical conditions and stability of the river, and surveys of macroinvertebrate populations.

Aquatic macroinvertebrate analysis utilizing the Biotic Condition Index (Winget and Mangum, 1979), when used alone, is a biotic measure of water quality. This methodology does incorporate habitat variables such as substrate type, gradient, and bank vegetation dominance, as well as water quality. Additionally, Humboldt River monitoring completed by Mitchell and Baumannn (1995) incorporated aquatic habitat condition analysis utilizing the Channel Stability Rating methodology employed by the U.S. Forest Service, Region 6 (Pfankuch, 1975). Macroinvertebrate monitoring and channel stability ratings were chosen as the preferred methods of stream biotic condition monitoring to overcome the inappropriate use of resident black fly population monitoring as an indicator of relative aquatic health.

Black flies are generally known to be indicators of poor water quality (Thorpe and Covich, 1991) and have been the target of an intensive abatement program in the Humboldt River for many years (R. Gray, personal communication). This abatement program has, at times, resulted in non-target organism mortalities in the Humboldt River system through the study area (French et al., 1986). Use of a methodology that requires statistically viable sampling frequency, effort, and intensity that samples the entire macroinvertebrate community and assigns a quantitative score based on the ability of organisms present to withstand perturbations is preferable in the monitoring of an aquatic environment.

## DESCRIPTION OF SAMPLE SITES

Aquatic monitoring completed in 1995 provided the initial foundation of a database on the physical condition and aquatic macroinvertebrate biota that populates the Humboldt River from Argenta to Rose Creek. Stations have been strategically placed throughout the study area to afford and allow valid comparisons between stations. Sampling and analysis of this community is planned for late summer and mid-winter on an annual basis until characterization of the community is complete. Sampling frequency will be adjusted to monitor potential changes in the river after characterization is complete.

The following are sample sites on the Humboldt River:

Station 1. **Argenta, (Lander Co.)** -- samples were collected below the grade control structure, where the substrate was quite diverse.

Station 2. **Battle Mountain (Lander Co.)** -- located one-fourth mile downstream from the Battle Mountain Bridge.

Station 3. **26 Ranch (Humboldt Co.)** -- located near Mote.

Station 4. **Stonehouse Bridge (Humboldt Co.)** -- located at bridge across from the North Valmy Station power plant.

Station 5. **Comus Gaging Station (Humboldt Co.)** -- located at the USGS gaging station.

Station 6. **Christensen Dam Bridge (Humboldt Co.)** -- located below the Christensen Dam Bridge.

Station 7. **Eden Valley Bridge (Humboldt Co.)** -- located just north of Golconda.

Station 8. **Reinhardts Bridge (Humboldt Co.)** -- located east of Winnemucca townsite.

Station 9. **Rose Creek (Humboldt Co.)** -- located just west of Winnemucca townsite.

## PHYSICAL CHARACTERISTICS OF HUMBOLDT RIVER

The Humboldt River from Argenta to Rose Creek (station 1 to station 9) represents roughly 72 air miles and approximately 200 channel miles when meander factors, channel braiding, and flood plain functions are considered. The Humboldt River through the study area is defined by a very low gradient. **Table 1** illustrates gradients observed in the Humboldt River from the upstream station through the most downstream terminus of the study area.

TABLE 1
RIVER GRADIENTS ON HUMBOLDT RIVER
IN VICINITY OF LONE TREE MINE

| Station ID → | Battle Mountain | Comus Gage | Christensen Dam | Winnemucca | Rose Creek |
|---|---|---|---|---|---|
| River Gradient → | 0.09% | 0.18% | 0.12% | 0.07% | 0.08% |

The wetted perimeter observed in the channel during sampling ranged from 65-feet wide at Argenta to 109-feet wide at Rose Creek. Water flow was active and contiguous throughout the entire river reach. The active river channel was comprised of a silt stream bed with areas of riffle comprised of large and small gravel. Most riffle areas were less than one-third the river width and were spatially associated with natural obstructions and flow deflectors. River banks were dominated by low vertical escarpments comprised of silt and sand. Most river banks were 3 to 12 feet high with bank slope gradients between 30 and 90 degrees. Many areas of mass wasting and sloughing of banks were observed. Riparian vegetation immediately adjacent to the river was dominated by grasses and shrubs. Vegetation density was low in areas adjacent to the river.

Channel stability was rated at each station using a quantitative scoring system based on qualitative observations (**Table 2**). Each station was evaluated based on features including mass wasting of banks, vegetative bank protection, channel capacity, bank rock content, flow obstructions, down cutting, deposition, rock angularity, substrate brightness, substrate particle consolidation, bottom material size distribution, scouring/deposition, and presence of aquatic vegetation. Implementation of this scoring system resulted in one-half of the stations being characterized as having fair channel stability and one-half of the stations having poor channel stability (**Table 2**). No correlation between station location and channel stability was observed.

The river channel was moderately incised into the valley floor. The active wetted channel migrates easily within the incised channel based on the flow available. Large and active areas of silt deposition and scouring were evidenced in the active channel. Historic and significant channel migration was evidenced at almost every station. The Humboldt River through the study area is a physically dynamic stream channel that experiences a great deal of flow fluctuation. Many areas of "losing" and "gaining" flow are observed during base flow periods. The low channel stability realized through the study area is largely influenced by dramatic flow variations and the fine-texture soils that comprise the channel and its banks.

TABLE 2
CHANNEL STABILITY RATINGS FOR HUMBOLDT RIVER
IN VICINITY OF LONE TREE MINE

| Rating | Humboldt River Stability Rating Site | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Argenta | Battle Mountain | Mote | Stonehouse | Comus | Christainsen Dam | Golconda | Winnemucca | Rose Creek |
| Excellent | 1 | 4 | 0 | 5 | 3 | 0 | 0 | 0 | 2 |
| Good | 20 | 4 | 4 | 22 | 0 | 0 | 4 | 8 | 20 |
| Fair | 48 | 42 | 75 | 18 | 60 | 84 | 63 | 66 | 48 |
| Poor | 34 | 62 | 44 | 52 | 52 | 32 | 48 | 40 | 40 |
| Score | 103 | 112 | 123 | 97 | 115 | 116 | 115 | 114 | 110 |
| Rank | Fair | Fair | Poor | Fair | Poor | Poor | Poor | Fair | Fair |

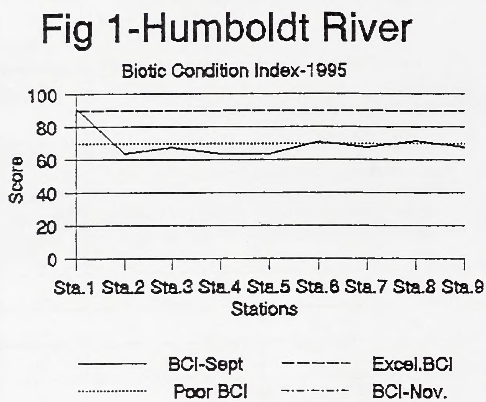
Note: < 38 = Excellent; 39-76 = Good; 77-114 = Fair; >115 = Poor.

## MACROINVERTEBRATE SAMPLING

Macroinvertebrate fauna of the Humboldt River from Battle Mountain to Winnemucca were sampled in the Fall of 1995. Actual sampling occurred later in the year than originally planned because of high water conditions in the river. Initial samples were collected in September 1995 with a second set of samples collected at one of the stations (#5) for substantiation purposes in November 1995. Quantitative samples were taken using a modified Surber sampler as described by Winget and Mangum (1979). The samples were sent to the entomology laboratory at Brigham Young University where the organisms were sorted, identified, counted and analyzed. Identifications were made using the following publications: Baumann et al. (1977); Edmunds et al. (1976); Merritt and Cummins (1988); Thorp and Covich (1991); and Wiggins (1977).

The actual area of the Humboldt River sampled for macroinvertebrates extends from Argenta in Lander County, east of Battle Mountain, to the confluence of Rose Creek in Humboldt County, west of Winnemucca. Collections were made upstream of the Rose Creek confluence. September 1995 samples documented blackflies of the family ***Simuliidae*** at all stations throughout the study reach except at the Comus Gage reach (station 5). The absence of blackflies at station 5 was assumed by the authors to be related to sampling. To test this assumption, additional sampling was undertaken in November 1995. The presence and relative abundance of blackflies at station 5 was verified by additional sampling completed at this station in mid-November. The density and abundance of blackflies observed at station 5 in November was similar to the September blackfly observations at all other stations. The observed similarity for Biotic Condition Index (BCI), Shannon-Weaver Index, and community tolerance quotient (CTQa) at station 5 in September and November samples indicates that environmental conditions had not changed substantially at this station in the elapsed period between sampling events (see **Tables 5** and **6**).

Results of sampling and analysis are presented in **Tables 3 through 6**. The upper control station near Argenta has the most macroinvertebrate taxa at 16. Station 1 contains the most sensitive organisms such as the stoneflies, ***Isoperla*** and ***Isogenoides***; mayflies, ***Cinygma***, ***Rhithrogena***, ***Ephemerella***, and ***Paraleptophlebia*** and the caddisfly genus ***Cheumatopsyche***. The CTQa, which identifies the macroinvertebrate community tolerance to perturbations, showed a value of 71 at station 1 and indicates a good macroinvertebrate community is present. This is reflected in the estimated Biotic Condition Index (BCI) value of 92 for station 1. This station is realizing 92% of its potential to produce a typical, diverse, native macroinvertebrate community.

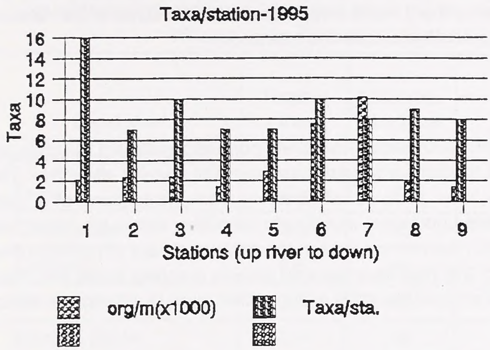



A marked change in the species composition of the macroinvertebrate community at the next station downstream, Battle Mountain (station 2), was illustrated by this effort. The Battle Mountain station is located upstream of the Lone Tree Mine discharge site. The number of taxa dropped to 7 and the sensitive taxa present at this station are absent. The CTQa value increased to 101 and the BCI value declined to 64 at station 2. Environmental conditions for macroinvertebrates are classified as poor based on the BCI score.

Taxa present are identified as tolerant to increased sediment and organic enrichment. Graphic representation of the relationship of BCI at each station and the scores required to rank the population as realizing excellent or poor potential is illustrated in **Figure 1**.

The number of taxa and organisms per square meter at each station is illustrated in **Figure 2**. The site where the Lone Tree Mine dewatering discharge enters the Humboldt River is between stations 4 and 5 (i.e., stations 1 - 4 are upstream of the discharge and stations 5 -9 are downstream of the discharge). The number of taxa, species composition, and BCI at stations 3 - 9 (from Mote to Winnemucca) are all similar to station 2. No stoneflies occur and the sensitive mayflies and caddisflies are absent at stations 2 - 9.

## Fig 2 Humboldt River




There are six hardy taxa that occur at almost every station: mayflies, ***Baetis*** and ***Tricorythodes***; caddisflies, ***Hydropsyche***; dragonflies, ***Ophigomphus***; and flies, ***Chironomidae*** and ***Simuliidae***.

Even though diversity has declined in stations 2 - 9, overall productivity has increased dramatically in stations 5 - 7 immediately downstream of the Lone Tree Mine discharge location. At stations 5 - 7, the biomass has increased significantly (2 to 20 times that of other stations) as has the number of organisms per square meter. Additional sampling completed at station 5 in mid-November identified a pollution sensitive stonefly genera, ***Taenionema spp.***. Most organisms at all stations were small at the time of sampling because they were early instar nymphs and larvae.

The Humboldt River above Battle Mountain to downstream of Winnemucca is alive with macroinvertebrates. The ecological condition of the river, as evidenced by the macroinvertebrate fauna present, appears to be homogeneous in this reach of the river. With the exception of some taxa that occur in the most upstream station at Argenta, resident organisms are all tolerant of sediment and organics. The tolerance quotients are usually 100 or above, which indicate that the macroinvertebrates are well-adapted to life in their environment. This observation is strengthened by the fact that the macroinvertebrates present occur in high numbers at each station.

Many factors could be responsible for the limited diversity of macroinvertebrate species and the low BCI scores observed in the Battle Mountain to Rose Creek reach of the river (stations 2 to 9). Discharge of municipal wastes, agricultural activities, industrial activities, aquatic insect abatement programs, and runoff from roads and highways are perturbation sources common to this river reach. Discharge of chemical pollutants and changes in aquatic habitat quality resulting from these activities favors the more pollution tolerant macroinvertebrate taxa such as those observed in this study. Based on the similarity of taxa and BCI scores from stations 1 through 9, the presence and interaction of these factors likely has occurred for a long

period of time along the Humboldt River. These perturbing factors could be responsible for the scarcity of sensitive taxa throughout much of the study reach.

Another factor in defining the limited diversity of macroinvertebrates could be the extensive fluctuations of flow that occur between and within annual hydrologic cycles in this river system. The amount and timing of flow is important in the establishment and maintenance of a macroinvertebrate community. Recent years of extended drought and resulting low flows have caused extensive areas of flow cessation in the river. These conditions are deleterious to the macroinvertebrate community of the Humboldt River.

Significantly higher biomass of macroinvertebrates in the reach immediately downstream of the Lone Tree Mine discharge suggests that flow conditions in the Humboldt River may be important in determining productivity of the macroinvertebrate community. High and sustained water flows realized in 1995 will improve macroinvertebrate conditions in the river. Future monitoring to determine the status of the resident macroinvertebrate community in the study area would elucidate this interaction.

## SUMMARY AND CONCLUSIONS

Initial monitoring results from 1995 for river stability and macroinvertebrate populations did not illustrate any recent perturbations in the river that reduced macroinvertebrate abundance or species diversity. The database collected and analyzed provides an initial point of reflection regarding allegations of a 1995 perturbation affecting the river macroinvertebrate population, specifically blackflies, below the Lone Tree Mine discharge site. Blackfly species observed in this river are known to be more tolerant of pollution than the other taxa observed in samples. Any impact that may have reduced blackfly numbers would also have eliminated the more sensitive taxa. Recent elimination of blackflies and the other more sensitive taxa cannot be substantiated by this monitoring effort.

The homogeneity of environmental conditions reflected in the similar BCI, taxa present, and production indicates that the river above and below the Lone Tree Mine discharge point are similar and have been for some time. If a perturbation occurred that impacted macroinvertebrates downstream of the discharge point, it could not have been ameliorated in the period of Spring to Fall 1995. In fact, it would require several annual life cycles of the impacted organisms to repopulate the river to it's present level. No adverse impact of Lone Tree Mine discharge has been evidenced by this database. Additional sampling would expand the database and increase its ability to describe and monitor the health of the Humboldt River and its aquatic inhabitants.

TABLE 3

List of Macroinvertebrates Recorded From the Humboldt River Between Battle Mountain and Winnemucca, Nevada, Samples Collected September 1995

| Organism | Trophic Level* | Tolerance Quotient | Stations | | | |
|---|---|---|---|---|---|---|
| | | | 1 | 2 | 3 | 4 |
| Ephemeroptera (Mayflies) | | | | | | |
| Baetis | Scr | 72 | 707 | 14 | 18 | 57 |
| Choroterpes | Scr | 60 | 14 | | 4 | |
| Cinygma | Scr | 32 | 11 | | | |
| Ephemerella | Scr | 48 | 4 | | | |
| Ephoron album | C-F | 48 | | | 4 | |
| Heptagenia | Scr | 54 | 54 | | | |
| Paraleptophlebia | C-G | 32 | 4 | | | |
| Rhithrogena | Ser | 21 | 4 | | | |
| Tricorythodes minutus | C-G | 108 | 276 | 1206 | 757 | 258 |
| Plecoptera (Stoneflies) | | | | | | |
| Isogenoides | Pred | 30 | 29 | | | |
| Isoperla | Pred | 18 | 25 | | | |
| Trichoptera (Caddisflies) | | | | | | |
| Cheumatopsyche | C-F | 108 | 11 | | | |
| Hydropsyche | C-F | 108 | 36 | 7 | 14 | 68 |
| Hydroptila | Scr | 108 | 4 | | | |
| Odonata (Dragonflies) | | | | | | |
| Ophiogomphus | Pred | 108 | 14 | 14 | 18 | 11 |
| Diptera (Flies) | | | | | | |
| Chironomidae | C-G | 108 | 854 | 1102 | 1371 | 746 |
| Hexatoma | Pred | 36 | | | 4 | |
| Simulium | C-F | 108 | 43 | 22 | 158 | 255 |
| Misc. Invertebrates | | | | | | |
| Hydracarina (Water Mites) | C-G | 98 | | 4 | 7 | 4 |

* C-F = collectors-filterers
Pred = predators
Shr = shredders
Scr = scrapers
C-G = collector-gatherers

8-22-96

| TABLE 4<br>Summary of Macroinvertebrate Sampling Data from the Humboldt River Between Battle Mountain and Winnemucca, Nevada, Samples Collected September 1995 | | | | |
|---|---|---|---|---|
| Parameter | Stations | | | |
| | 1 | 2 | 3 | 4 |
| Total number of taxa | 16 | 7 | 10 | 7 |
| Mean number/square meter | 2088 | 2368 | 2354 | 1399 |
| Standard Deviation | 1157 | 999 | 510 | 192 |
| Grams/square meter | 0.1 | 0.1 | 0.2 | 0.2 |
| Dominance Community TQ=CTQd | 78 | 103 | 96 | 102 |
| Shannon Weaver Idenx = d | 2.2 | 0.2 | 1.9 | 1.9 |
| Average Community TQ=CTQa | 78 | 1.1 | 96 | 101 |
| Predicted Community TQ=CTQp | 65 | 65 | 65 | 65 |
| Percent of Predicted = BCI | 92 | 64 | 68 | 64 |

| BCI | SCALE | CTQa | SCALE |
|---|---|---|---|
| Above 90 | Excellent | Below 60 | Excellent |
| 80-90 | Good | 60-70 | Good |
| 70-80 | Fair | 70-80 | Fair |
| Below 70 | Poor | Above 80 | Poor |

## TABLE 5
### List of Macroinvertebrates Recorded from the Humboldt River Between Battle Mountain and Winnemucca, Nevada, Samples Collected September 1995 (*November 1995*)

| Organism | Trophic Level* | Tolerance Quotient | Stations | | | | |
|---|---|---|---|---|---|---|---|
| | | | 5*(Nov)* | 6 | 7 | 8 | 9 |
| Ephemeroptera (Mayflies) | | | | | | | |
| Baetis | Ser | 72 | 32 | 122 | 230 | 22 | 11 |
| Ephoron album | C-F | 96 | | 4 | | 25 | 7 |
| Heptagenia | Ser | 98 | | 7 | 4 | 4 | |
| Tricorythodes minutus | C-G | 108 | 592(*22*) | 359 | 1417 | 596 | 617 |
| Trichoptera (Caddisflies) | | | | | | | |
| Hydropsyche | C-F | 108 | 1098(*739*) | 3599 | 5802 | 269 | 126 |
| Odonata (Dragonflies) | | | | | | | |
| Argia | Pred | 108 | | 4 | | | |
| Ophiogomphus | Pred | 108 | 11 | 4 | 25 | 11 | 4 |
| Diptera (Flies) | | | | | | | |
| Chironomidae | C-G | 108 | 1195(*2275*) | 3401 | 2623 | 858 | 596 |
| Simulium | C-F | 108 | (*158*) | 36 | 54 | 86 | 36 |
| Misc. Invertebrates | | | | | | | |
| Hydracarina (Water Mites) | Pred | 98 | (*4*) | | 4 | 18 | |
| Gastropoda (Snails) | | | | | | | |
| Ancylidae (Limpets) | Scr | 96 | 4 | 4 | | | |
| Pelecyponda (Bivalves) | | | | | | | |
| Corbiculidae (Mussels) | C-F | 108 | | | | | 7 |
| Oligochaeta (Sludge Worms) | C-G | 108 | 4(*151*) | | | | |

* C-F = collectors-filterers
22 Pred = predators
Shr = shredder

Scr = scrapers
C-G = collector-gatherers

## TABLE 6
## Summary of macroinvertebrate Sampling Data from the Humboldt River Between Battle Mountain and Winnemucca, Nevada, Samples Collected September 1995 (*November 1995*)

| Parameter | Stations | | | | |
|---|---|---|---|---|---|
| | 5 (*November*) | 6 | 7 | 8 | 9 |
| Total number of taxa | 7(*7*) | 10 | 8 | 9 | 8 |
| Mean number/square meter | 2939(*3362*) | 7542 | 10158 | 1887 | 1399 |
| Standard Deviation | 1859(*2378*) | 3882 | 7009 | 562 | 199 |
| Grams/square meter | 0.5(*0.3*) | 1.1 | 2.1 | 0.1 | 0.1 |
| Dominance Community TQ=$CTQ_d$ | 102 | 98 | 102 | 96 | 101 |
| Shannon Weaver Index = d | 1.7(*1.4*) | 1.4 | 1.6 | 1.9 | 1.6 |
| Average Community TQ=$CTQ_a$ | 101(*96*) | 91 | 95 | 90 | 96 |
| Predicted Community TQ=$CTQ_p$ | 65 | 65 | 65 | 65 | 65 |
| Percent of Predicted = BCI | 64(*68*) | 71 | 68 | 72 | 68 |

| BCI | SCALE | CTQa | SCALE |
|---|---|---|---|
| Above 90 | Excellent | Below 60 | Excellent |
| 80-90 | Good | 60-70 | Good |
| 70-80 | Fair | 70-80 | Fair |
| Below 70 | Poor | Above 80 | Poor |

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# STREAM FLOW AND ITS INFLUENCE ON FISHERIES

by Michael J. Mitchell, Senior Aquatic Biologist
Queen of the River Fish Co., Inc.

Stream flow includes stream discharge, stream discharge timing, and stream discharge intensity. Stream flow has been determined to impact riverine fisheries significantly (Alabaster 1977; Dauble 1994; Hynes 1970; Wilcox and Willis 1993). Dauble (1994) links declines in anadramous fishes in the Yakima River, Washington to reduced flows; Crance (1984) identified high flows as essential to the spawning migration of striped bass; French (1994a) correlated walleye spawning migrations in the Humboldt River to normal/high stream flows; McMahon et al. (1984) stated adequate stream flows are essential to transport walleye fry back downstream to a standing water body before yolk sac absorption is complete; and Cambray (1991) postulates that reduced flow facilitated spawning of redfin minnows in the highly regulated Groot River in South Africa.

Adequate flows are essential to create prescribed habitat requirements needed to meet life history requirements of individual fish species. Habitat Suitability Models identify the complex array and interaction of variables required to sustain fish in their appropriate habitats (Crance 1984; Hickman and Raliegh 1982; Edwards et al. 1983; McMahon et al. 1984; Stuber 1982; Trial et al. 1983a and 1983b). Flow (thalweg depth and water velocity) is identified in virtually all of these models as an essential component of the habitat requirements for fluvial fish populations. It is reasonable to assume that the occurrence of extended low flow to intermittent no flow periods in the Humboldt River is detrimental to resident aquatic biota. It is also reasonable to assume that these conditions have contributed to the demise of a number of native and introduced non-native fish in the Humboldt River channel upstream of Rye Patch Reservoir.

Water quality monitoring of dewatering discharge from the Lone Tree Mine has identified this water as adequate in quality for the support of resident fish except for temperature. Installation of the cooling pond system has mediated this issue and the temperature discharge requirements imposed by the State of Nevada should be satisfied. Water resource estimates for dewatering discharge from the Lone Tree Mine into the Humboldt River would be approximately 123 to 167 cubic feet per second (cfs). Channel stability evaluations indicate that the channel capacity of the existing Humboldt River channel is adequate to convey these flows even during traditional high flow periods.

While increasing the average high flow by 20%, the most dramatic period of flow alteration would occur during the base and low flow August-December period. Predicted flows at the Comus gage would realize a new base flow of 196 cfs, almost 7 times the average historic base flow. Utilizing the stream cross section 160 feet downstream of the Comus gage, discharge into the Humboldt River from the Lone Tree Mine would increase wetted perimeter during base flow periods by 26% and maximum depth of this cross section increases by 53%. Low flow periods during late August through December are critical in the survival of aquatic biota in the river due to reduced water quality, predator/prey interaction, crowding, and reduced habitat availability. Higher flows during base and low flow periods would increase the area of habitat available for all resident aquatic biota, increase the flushing rate of pools and backwaters, and provide a more stable flow regime in the river. The quality of aquatic habitat created by increased flow would be dependent on the velocity, depth, and substrate underlying the flow. It is reasonable to assume that the distribution of habitat alteration will not be uniform throughout the river reach between the discharge point and the Humboldt Sink.

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# APPENDIX L

(Table from HCI (1994a) Report that summarizes distribution of recharge and precipitation in the Vicinity of the Lone Tree Mine)

TABLE 3

Distribution of Recharge and Precipitation in Hydrologic Study Area

| Precipitation (inches) | Elevation Range (ft, NGVD) | Percent Recharge | Area (square miles) | Recharge (cfs) |
|---|---|---|---|---|
| 20+ | 7600+ | 25 | 4 | 1.7 |
| 15-20 | 6500-7600 | 15 | 26 | 5.1 |
| 12-15 | 5700-6500 | 7 | 36 | 2.6 |
| 8-12 | 4600-5700 | 3 | 334 | 7.3 |
| 0-8 | <4600 | 0 | 350 | 0.0 |
| Total | | | 750 | 16.7 |

Source: Hydrologic Consultants, Inc.(HCI). 1994a. Hydrogeologic Framework and preliminary numerical ground-water flow modeling of region surrounding Santa Fe Pacific Gold Corporation's Lone Tree Mine, Humboldt County, Nevada. Prepared for Santa Fe Pacific Gold Corporation. Valmy, Nevada. October 1994. HCI-834.

# APPENDIX M

(Snail Survey Report for Springs
in the Vicinity of the Lone Tree Mine)

McGuire Consulting, PO Box 764, Espanola, NM 87532 (505) 753 9457

April 22, 1996

Terry Grotbo
Maxim Tech
1610 B St.
Helena, MT 59601

Re: Lone Tree Mine Expansion EIS - springsnail surveys

I conducted a survey of mollusks in springs and seeps within the Lone Tree EIS study area on April 18-19, 1996. No springsnails were found at any of the springs in the study area. Furthermore, there was no evidence that springsnails had occurred at any of these sites in the recent past.

I visited the eight spring/seep sites that have been, or may be, impacted by mine dewatering (Lone Tree Mine Draft EIS). In addition, I examined the Brooks Spring stock tank and associated wetlands (supplied with water from the mine) and two unnamed springs (BLM #64-42 and 65-8) outside the primary study area. The unnamed springs were identified as the most likely sites for springsnails based on descriptions and pictures in the Lone Tree Spring Survey report.

Sincerely,

Dan M

Daniel L. McGuire
Aquatic Biologist
McGuire Consulting

McGuire Consulting, PO Box 764, Espanola, NM 87532 (505) 753 9457

**Mollusk survey of springs and seeps in the Lone Tree Mine Expansion EIS Study Area, Humbolt County, Nevada.** Conducted by Daniel McGuire 4/17-20/96.

1. **Stonehouse Spring** (T34N, R41E, Sec 1, SW)
   Dry - no mollusks or shells present.
   old stream channel runs through livestock pen - no riparian vegetation but some grass and dead cottonwoods.

2. **Planck Spring** (T34N, R41E, Sec 12, NW)
   Dry - no mollusks or shells present.
   no riparian vegetation - no evidence of recent surface water.

3. **Brooks Spring** (T34N, R41E, Sec 13, NE)
   Dry - no mollusks or shells present in old channel.
   no riparian vegetation and no evidence of recent surface flow in old channel.

3a. **Brooks Spring Stock Tank** (T34N, R41E, Sec 13, NE)
   ~40 gpm pumped from mine to stock tanks-
   common pond snails, *Stagnicola* sp., present in excavated catchment pond. No mollusks found in stock tanks or surface flow below the pond.

4. **Hot Pot Springs** (T35N, R43E, Sec 30, SW)
   Dry - no mollusks or shells present in spring, old channel or adjacent seep areas.
   no surface water in Hot Pot or adjacent seep areas.
   Substrate in bottom of "Hot Pot" was dry.

5. **Treaty Hill Spring** (T35N, R43E, Sec 31, NE)
Dry - no live mollusks found, empty *Planorbella* sp. shells were numerous. This is a common "ramshorn snail" found in Humbolt River backwaters.
no surface water; however, soil was damp and rushes (last years) were present. This area appears to flood or at least get subsurface moisture from the Humbolt River. no live snails present.

6. **Ames Spring** (T33N, R43E, Sec 16, SE)
Surface flow ~2 gpm. - no live mollusks or shells found. Seep area with nonfunctional stock tank- ~ 1 acre of wetlands associated with this spring- heavily grazed.

7. **Mud Spring** (T33N, R43E, Sec 20, SW)
Surface flow ~1 gpm. - no live mollusks or shells found. Seep area ~ 1/2 acre of wetlands associated with this spring- heavily grazed.

8. **Sulfur Spring** (T35N, R41E, Sec 34, NW)
Surface flow from stock tank ~ 2 gpm - no live snails or shells, *Pisidium* sp. present below stock tank (Pisidium is a common "pea clam"). Some standing water in cistern. Moist soil but very little surface water in seeps along the hill to the north of the spring.

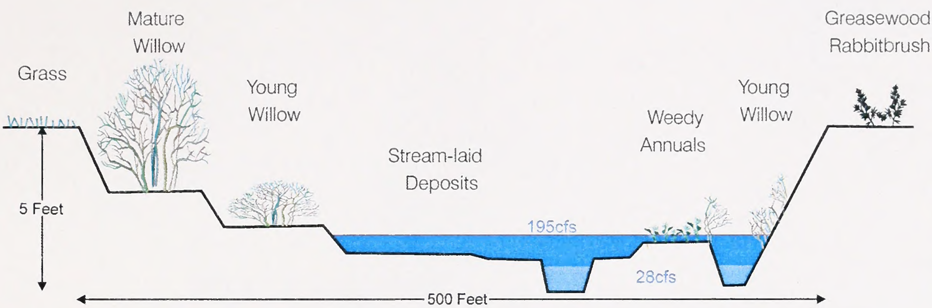
9. **unnamed spring on north slope of Battle Mountain BLM #64-42** (T33N, R43E, Sec 27, 34)
Stream surface flow >10 gpm on 4/19/96. No mollusks present. Appears to be ephemeral, fed by snow melt.

10. **unnamed seeps on Cumberland Creek BLM #65-8** (T33N, R40E, Sec 16)
Perennial stream flowing several cfs, seep areas above channel moist but without surface water. Common snails, *Physella* sp. common in stream.

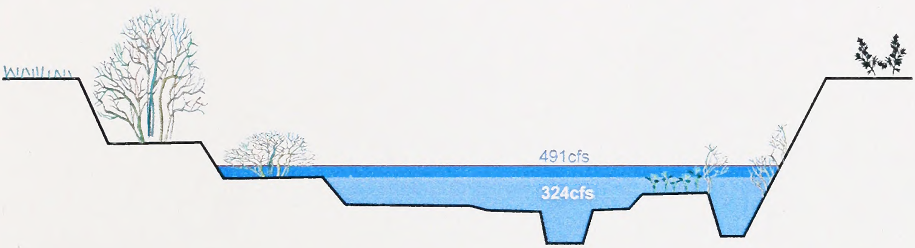
# APPENDIX N

(Cross sections of Humboldt River showing water level changes)

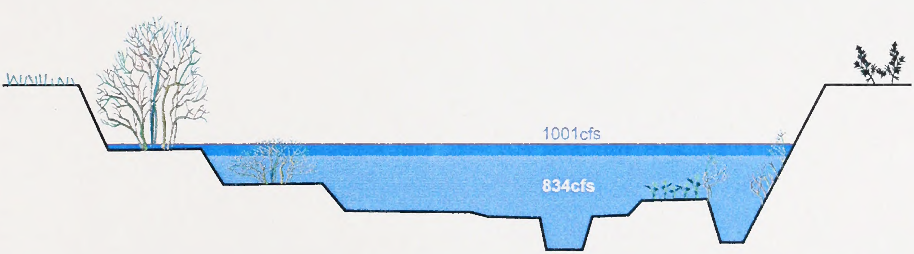
# Typical Cross Section For Irregular Channel




Baseflow (28cfs) + Maximum Mine Discharge (167cfs) = 195cfs




Average Annual Flow (324cfs) + Maximum Mine Discharge (167cfs) = 491cfs




Maximum Average Monthly Flow (834cfs) + Maximum Mine Discharge (167cfs) = 1001cfs